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Government Requires Millions of Cast Shells

To Meet the Needs of the Ordnance Department Will Tax the Capacity of Gray and Malleable Iron Foundries of the Country

SEMISTEEL shell requirements of the government and the allies are mounting to tremendous proportions. The program now involves the production of approximately 33,000,000 of these cast projectiles in 3, 4.7, 6 and 8-inch sizes during the next 12 months. This will engage upwards of 20 per cent of the gray and malleable iron producing capacity of the country and it is estimated that 1,000,000 tons of metal will be required of which about 700,000 tons will be pig iron and 300,000 tons steel scrap, assuming that a 30 per cent semisteel mixture is employed. In view of the large allocations of foundry iron recently made to plants producing essential castings, the problem of obtaining a sufficient supply of pig metal for semisteel shell manufacture already is causing considerable concern. It will result in the further restriction of iron deliveries to the shops classified among the nonessential, but fortunately the shell program will afford them an opportunity to obtain essential work, provided they have the proper equipment and the operating force has had some experience in meeting rigid specifications.

Shell Making to Be Studied

Since a knowledge of cast shell manufacture is practically foreign to all of the American foundrymen, steps already are being taken to obtain details of the process, as successfully carried out in several plants in this country. These data will form the basis for suggested recommended practice which will prove to be an invaluable aid to foundrymen engaging in this work. Not only will the molding methods be considered, but the process will be studied and described from the metallurgical standpoint. This method of procedure will eliminate a large amount of individual experimental work, will avoid delays and losses and will facilitate production. In the completion of this information, the experience of French foundrymen also will be taken into consideration and it is expected that many difficulties that otherwise would be encountered will be obviated. A committee of foundrymen, advisory to the ordnance division of the war department now is engaged on this work and the report will be soon available.

A large proportion of these shells are to be machined all over and machine shop facilities will be taxed to the utmost to keep pace with the foundry production. Existing capacity, of course, will be utilized to the limit, but it is certain that a large number of special lathes will have to be built for this purpose. Also, it is doubtful if there is a sufficient number of physical testing machines in the foundry laboratories of this country to make progress tests, since it is essential that the foundryman doing this work maintain constant control of the quality of his product as the shells are not tested until after they are machined. Without these daily foundry tests, the shell manufacturer will be without knowledge of the quality of his output until after the reports are received from the machine shop and this might result in the rejection of several days' or weeks' output, depending upon how close the machine shop and inspector are working to the foundry production. Manufacturers of testing apparatus are many months behind in their deliveries and the casting plants equipped with physical testing apparatus are fortunately situated with reference to shell work.

At the request of the chamber of commerce of the United States an important meeting of malleable casting manufacturers of the country recently was held in New York. The extent of the semisteel requirements was outlined and all of the manufacturers in attendance pledged their support in carrying it out to the maximum of their ability.

Malleable Service Committee Organized

For the purpose of organizing the industry for war service, a committee was elected as follows: Frank J. Lanahan, chairman, president, Fort Pitt Malleable Iron Co., Pittsburgh and president of the American Malleable Castings association; H. F. Pope, president, National Malleable Castings Co., Cleveland; John C. Haswell, president, Dayton Malleable Iron Co., Dayton, O.; F. L. Sivyer, president, Northwestern Malleable Iron Co., Milwaukee, and John E. Walker, president, Wilmington Malleable Iron Works, Wilmington, Del. Inasmuch as the meeting was attended by malleable iron manufacturers generally, regardless of their affiliation with any particular organization, the war service committee named will be certified to the war in-

dustries board as the unanimous choice of the industry. This committee originally was appointed by the American Iron and Steel institute to consider all matters concerning malleable iron castings. It subsequently was indorsed at a meeting of malleable manufacturers held at Chicago and is considered as ably representative of the industry and is qualified for the most effective co-operation with the government.

Speakers at this meeting included Samuel P. Bush, president of the Buckeye Steel Castings Co., Columbus, O., now a member of the forgings ordnance, small arms and ammunition department of the war industries board, and Maj. R. A. Bruce of the ordnance department. The meeting was called to order by Franklin C. Parks, representing the chamber of commerce of the United States, and Frank J. Lanahan was elected chairman. The basis on which government contracts are let and the extent to which individual manufacturers are counted upon in meeting war requirements was explained by Mr. Bush. He said that it is one thing to secure a contract and it is an entirely different proposition to execute it. For this reason the government is exercising great care to place contracts only with responsible companies since each contract is a part of the general program and failure on the part of any contractor involves restrictions of the entire program to that extent.

Extent of the Malleable Industry

The extent to which malleable castings now are taking the place of steel castings in railroad car construction, and certain changes in specifications which now are under way in order to make certain castings a more practical foundry proposition were outlined by Mr. Lanahan. He also recounted the steps already taken, such as the retaining of an eminent metallurgist, and of an expert cost accountant, which, by putting the malleable industry upon a high and sound basis, are greatly increasing the value of this industry to the country. His remarks developed the fact that the malleable industry is unique in voluntarily having increased the physical requirements of its own product. The extent to which the malleable industry has grown was illustrated by Mr. Lanahan in a statement that the capacity of the country's malleable shops now is about 1,000,000 tons a year, valued in the neighborhood of $160,000,000.

Unique Price Table Described

H. J. H. Redhead, National Malleable Castings Co., Cleveland, displayed a price table which he said had been drafted after an exhaustive study and investigation of malleable iron foundry costs. The table is based upon conditions in various shops, in various parts of the country, said Mr. Redhead, and undoubtedly will serve for permanent use; the prices listed, he said, can be elevated or lowered in accordance with conditions prevailing at the time a change is desired. In this table, Mr. Redhead said, the profit is the same for light castings at 30 cents a pound as for heavy castings at 7 cents per pound. Slides which were used to illustrate Mr. Redhead's remarks showed that the cost of labor in malleable foundries now is more than 100 per cent higher than up to the latter part of 1915; that the cost of castings increases inversely as their weight; that the cost of light cored castings increases more rapidly than the cost of plain light castings; that the cost of a casting increases in accordance with the weight of the mold; that immigrant labor from southern Europe is only 80 per cent as efficient as the average American-born worker and that the negro is only 60 per cent as efficient as the white American-born worker, etc.

Malleable Facilities for Making Shells

The facilities of the malleable foundry industry for the manufacture of cast shells were comprehensively described in an address by Enrique Touceda, consulting engineer, Albany, N. Y. Through his prominent connection with the technical work of the American Malleable Castings association, Mr. Touceda is in a position to speak with authority. He outlined briefly the growth of the malleable casting industry in the United States, with particular reference to the progress that has been recorded in the past few years in improving the quality and uniformity of malleable through the concerted application of scientific research and control by leading manufacturers.

With reference to the work of the American Malleable Castings association in this connection and its possible bearing on the cast shell program, Mr. Touceda said in part:

"Before entering into a discussion of the manufacture of semisteel, I would like to give you, for your guidance, a line on how our tensile test bars have run for the past three months, asking you to consider the fact that we have been handicapped through difficulty in obtaining proper pig irons and proper fuels. In May the average ultimate strength of all bars was 50,171 pounds per square inch and the average elongation, 10.78 per cent; in June the average ultimate strength was 50,235 pounds, and the average elongation, 11.14 per cent; in July the average ultimate strength was 50,715 pounds and the average elongation, 11.59 per cent.

Air Furnace Semisteel

"It is an incontrovertible fact that semisteel can be made in an air furnace with great uniformity and with higher physical properties than is possible in the cupola. While it is unquestionably true that semisteel is being made in large quantities in the cupola, in our judgment it certainly is not the appartus best suited for that purpose. In the air furnace the entire charge is placed in the hearth and the fuel does not come in contact with the molten metal. The malleable industry is a very large one, with a capacity of about 1,000,000 tons per year. I am asked to tell you that any knowledge we have gained through the work referred to is entirely and without reserve wholly at the disposal of the government.

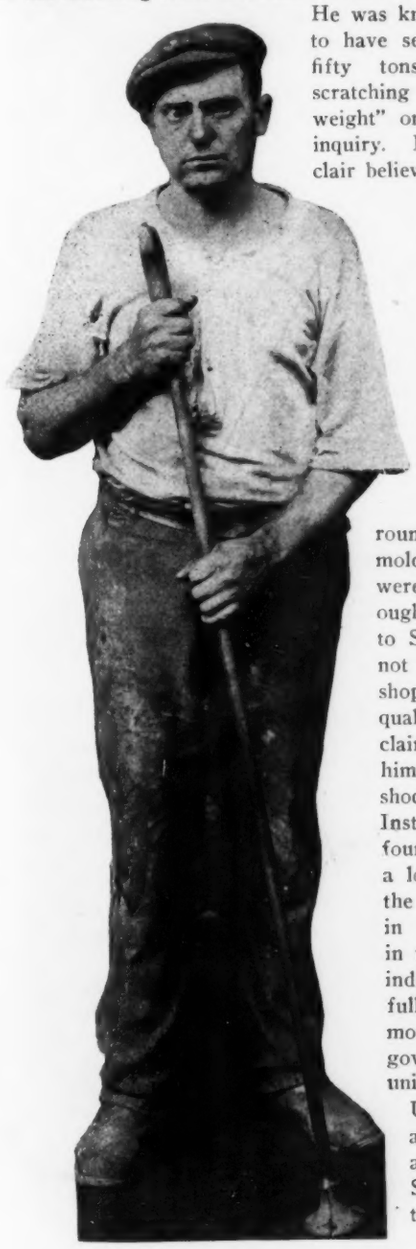
"We are arranging to have cupolas working as accessories to the air furnace and already, at one plant, have electric furnaces for the production of malleable iron castings. Any experiments that it may be necessary to make prior to the adoption of a specification we are willing and equipped to make. Our laboratories are complete and at the disposal of the government for research work along this line. We also are willing to train inspectors to hasten this end of the work. Finally, if by suggestion or study we can aid the authorities in any manner whatsoever, this we stand ready to do."

Your Biggest Foundry Problem---Manpower

More Castings With Less Labor is What the War Demands—Machines Must Do the Work of Men

BY H COLE ESTEP

IT was half past eight, so George Sinclair, superintendent of the Brownlee foundry, returned to his dusty roll-top desk in the little glass box at one end of the building to look over the morning mail. Such was Sinclair's invariable custom. First a stroll about the shop to see that all the boys were busy, then a return to the office to go through the ceremony of examining the day's correspondence, which seldom exceeded three pieces. Reading the mail was more a matter of habit than purpose with Sinclair, for on those rare occasions when a reply seemed unavoidable he merely scrawled a few words on the bottom of the incoming letter and sent it back to stare mutely in its author's face.



He was known on one occasion to have secured an order for fifty tons of castings by scratching "$9 a hundred weight" on the bottom of the inquiry. Like Napoleon, Sinclair believed that if a letter is left unanswered for a week, the necessity for a reply will have passed. His methods were Napoleonic in other ways, in that they were said by some to be a century behind the times. Those scoffers, however, overlooked the fact that Sinclair was a craftsman of rare ability, and that unconsciously, almost, he had surrounded himself with many other men, molders, melters, coremakers, etc., who were unusually able. He believed thoroughly in the skilled hand. Manpower, to Sinclair, meant ability to accomplish, not merely massed human energy. His shop, therefore, had a reputation for quality that was enviable. What Sinclair really needed was a shock to jar him out of the ruts of life. The shock arrived via the morning post. Instead of three pieces of mail he found four. The interloper was a long thin franked envelope from the district board advising Sinclair, in stilted official phraseology, that in the opinion of the board and its industrial advisers, ten of his carefully trained force would be of more service to the government in the uniform of the United States army than in overalls and jumpers. Sinclair ran over their names in his

TODAY THE MOLDER'S RAMMER—TOMORROW THE FIGHTING MAN'S RIFLE

Although the foundry business ranks high in the list of essential industries, the need for more soldiers is so pressing that foundrymen must expect to have their working forces severely depleted through the operations of the draft. Nevertheless production must not be allowed to suffer and the labor-power of men called to the army must be replaced largely through the more intensive utilization of machinery

A CLEANING ROOM GANG WHEN MEN WERE PLENTIFUL

This shows a gang of 19 men employed in a cleaning room of a large eastern foundry prior to the installation of modern sand-blasting apparatus

mind—Peterson, Rawlins, Sprotsky, Miller, Baabka, Rose, Johnson, Maschke, Bipto, Smith—every one was specially skilled in at least one direction. Peterson could mold gears by hand better than any man in the state. The teeth were not more than 1/32-inch oversize owing to the care with which Pete rapped the pattern. Baabka was a whiz on mower frames; with his unaided strength and skill, he could ram-up, roll-over and close four molds a day and pour them off as well. He very seldom lost a casting. As for Smith, he was assistant foreman in the coreroom and worked almost by sheer intuition. He would open the core-oven door a trifle, peer in, sniff, rest his hand on the door jamb, and then walk around to the firing pit which was located in the rear of core ovens.

"A little more fire, Rooney," would be his command to the handyman. Almost at the same time, he would turn to the labor boss with the order, "Take 'em out at half-past two, Pedro."

And didn't everyone know that Pedro always found the cores in perfect condition?

These men were skilled, valuable, indispensable.

"Indispensable," that was it. Sinclair spoke his thoughts aloud, as he sat with his feet on the desk and pondered his problem. He continued the soliloquy for the benefit of a rusty letter press and his office

FEWER MEN AND MORE MACHINES—A WARTIME CLEANING ROOM FORCE

With the aid of sand-blasting machines these nine men handle as much work as the 19 shown above. In other words modern machinery in this case has released the equivalent of 10 men for the army

force, represented by Bill, the timekeeper.

"How c'n a feller run a foundry without men, Bill? The pigs don't trot up to the chargin' floor on their own four legs, do they? And ain't the foundry business on this 'ere preference list, got up by the war industry board? Our shop's indispensable and so's our men. No men, no shop. I'm going up to Chicago and see this smart Aleck who signs himself, 'industrial adviser'. Perhaps he'll give me some *advice* on this manpower problem."

Sinclair's troubles are by no means unique. Everywhere throughout the country, from Florida to Washington and from Minnesota to Texas, in big shops and little ones, the problem of the hour may be stated in the same terms—"How can I meet the demands of the government by turning out more and better castings with less men?" The army must get the men it needs to put through our tremendous program in France. These men will be taken out of industry as were the 3,000,000 that have already been inducted into the service. At the same time the enlarged army will require an increased quantity of supplies of every sort, particularly shells, guns, trucks, tractors, railroads and ships. In the cast shell field alone, the government is now in the market for 33,000,000 projectiles. And already the shortage of unskilled labor is estimated at 1,000,000 men, while the skilled workmen's reserve, created sometime ago by the department of labor, is almost entirely exhausted. *Manpower* has assumed a prominence in the war vocabulary of industry fully equal to that hitherto assigned to *non-essential* and *priority*.

It is not a new problem to American foundrymen; the necessity for saving labor has been ever before these progressive casting manufacturers. Under present conditions, however, when men are molders today and soldiers tomorrow, the problem is tremendously intensified and focused to a burning point on the day's output. Every foundryman realizes it is his patriotic duty not only to maintain but to increase the production of his plant. By solving the problem of more castings with less men, the foundryman makes the most effective possible contribution to his country's cause. Let us again turn our attention, therefore, to the adventures of George Sinclair on his trip to Chicago to interview the industrial adviser of the district draft board.

* * *

"Yes, Mr. Sinclair, we agree heartily with almost everything you have said." James Morgan, industrial adviser to the district exemption board in Chicago, was a heavy set man with a deliberate manner of speech. He continued, "There is no doubt your plant is absolutely essential and I have heard good reports regarding the kind of good work you turn out."

Sinclair's face beamed, but Morgan quickly checked the rising elation.

"Although we appreciate all these points we have been talking about for the last half hour, Mr. Sinclair," Morgan went on relentlessly, "still you are also sufficiently broad-minded, I believe, to be able to see the proposition from the government's point of view. The army needs men. We must have four million in France by next June and five million in the army at that time, as you know. This takes no account of the navy, nor of the hundreds of thousands of men required for the Red Cross, the Y. M. C. A. work abroad, civilian work behind the lines in France, etc. These men, as you have heard it explained before, must come out of industry, and our only job is to take them out with the least possible damage. Therefore, although your industry may be indispensible, and some of your men equally so, it is all a matter of relative importance and since we must take a certain number of men from your town, and consequently from your shop, we have tried to pick those who should, from the government's standpoint, be in the army and whose work at home could be done in some other way—". Sinclair interrupted, speaking rather hotly.

"But these men are all specially skilled, Mr. Morgan, you don't seem

ANOTHER EXAMPLE OF LABOR ECONOMY IN THE CLEANING ROOM

Before the installation of a Pangborn sand-blast outfit 30 hours were required for cleaning this large gas-engine cylinder. It is now cleaned in one hour and several men are released for other work

HOW THREE MEN CAN UNLOAD A CAR OF PIG IRON

Usually when a carload of pig iron arrives a gang of 10 or 12 laborers is set to work unloading it—With the aid of a roller conveyor of the Mathews type, these men can do the job in less time

to understand I've trained 'em over a period of years. They're not ordinary dubs by any means."

"The army don't want dubs," Morgan cut in severely.

Sinclair hesitated for a fraction of a second.

"I know that, but you must take some account of skill, long training, special liking for foundry work, etc. Now, take our man Rawlins. He's been in our cleanin' room for five years. He knows the game. Perhaps you don't think it takes skill to clean castings, but I am here to tell you our work couldn't go on without that fellow."

"I thoroughly appreciate the necessity for skilled men in the cleaning room, Mr. Sinclair," Morgan replied. "You see I am in the foundry business myself—in a small way—so I happen to be slightly familiar with these problems." As a matter of fact, Morgan was chief engineer for a concern which probably made more castings in a day than the Brownlee foundry turned out in a week.

"Now, Mr. Sinclair, how many men are there in your cleaning room gang?"

"From 10 to 12."

"I suppose you have all modern improvements, including an up to date sand-blasting outfit?"

"Well, we're pretty well equipped, but we haven't got a sand-blast. You see our work is different and our skilled men—"

Morgan interrupted.

"That's just the point, Sinclair. Some of your skilled men are going into the army. You've got to substitute machine power for manpower. And after you've done it, I'll lay a bet you'll kick yourself because you didn't start the process of regeneration several years ago. Just take a look at these photographs for instance."

How the Cleaning Gang Shrunk

Morgan turned to a drawer in his desk and drew out two photographs. (They are reproduced on page 444.)

"Here you see a cleaning room gang consisting of 19 men. They handled the work in a middle western foundry which turns out about 40 tons of casting a day. They didn't believe in sand-blasting either, but finally they were convinced and here is the result."

Morgan drew Sinclair's attention to the other picture.

"You will note the cleaning room gang has shrunk to nine men. There you have it. Ten men released for the army and the remaining nine doing more work and better work than the whole gang ever performed on their most successful day."

Morgan continued with growing enthusiasm.

"The substitution of machine power for manpower, Mr. Sinclair, is not only a military, but an economic necessity. Why, I remember in one of our shops we used to spend all day cleaning a certain pulley which was 50 inches in diameter and weighed about 3800 pounds. Now we do it in the sand-blast in about an hour. In our steel foundry we make a good many annealing boxes. Actually it used to take us five days to clean one of them by hand. These boxes are 12 feet in length on the outside, 10 feet on the inside, 4 feet wide and 3 feet deep. They weigh about 12,000 pounds. Nowdays we shove the whole casting into a big sand-blast room and bring her out slick as a whistle in seven hours. In spite of rising wages, the cost of cleaning our small steel castings has been cut from 51 to 40 cents a ton. We are at present pouring about 30 tons of small open-hearth steel castings every 24 hours and we pay our head sand-blast man 40 cents a ton for all metal charged in the furnace. Don't, however, think for a minute I hold any special brief for the sand-blast machinery manufacturers. I simply cite this as an example. I dare say there are numerous other places in your foundry where you could substitute machines for men with profit, Sinclair, for I gather the impression you've always been a believer in the skilled man rather than the skilled machine.

"Before you go, however, just take a look at another photograph, which is one of the most striking illustrations of the difference between

manpower and machine power I've ever seen. I keep it handy and in this draft work find I have need for it frequently," Morgan added with a smile. (This photograph is reproduced on this page.)

"Here is a jar-ram, roll-over pattern-drawing machine juggling a flask that weighs over a ton. Beside the machine stands Tony. You're enough of a foundryman, Sinclair, to guess how many men like Tony it would take to roll that flask over, even with the aid of a crane, and how many hours it would take Tony and a couple of helpers to ram-up the sand and draw the pattern. Tony and a single helper with the aid of this machine put up this big flask, including setting all the cores, in a couple of hours."

"Now, Mr. Sinclair," said Morgan, rising, "it's up to you, and I hope your boys all come back from the war safe and sound."

* * *

In the foregoing dialog we have attempted to outline the fundamental principles of the great problem which confronts the American foundry industry today. There are several answers to the question, "How can I make more castings with less men?" For some operations, particularly coremaking and light molding on machines under proper conditions women can be employed. This phase of the problem has been thoroughly discussed in THE FOUNDRY and other publications during the past year, so it will not be enlarged upon in this article. There are hundreds of foundrymen, however, who ought to give the question of employing women intensive study from the standpoint of conditions existing in their own shops.

Scientific Management Again

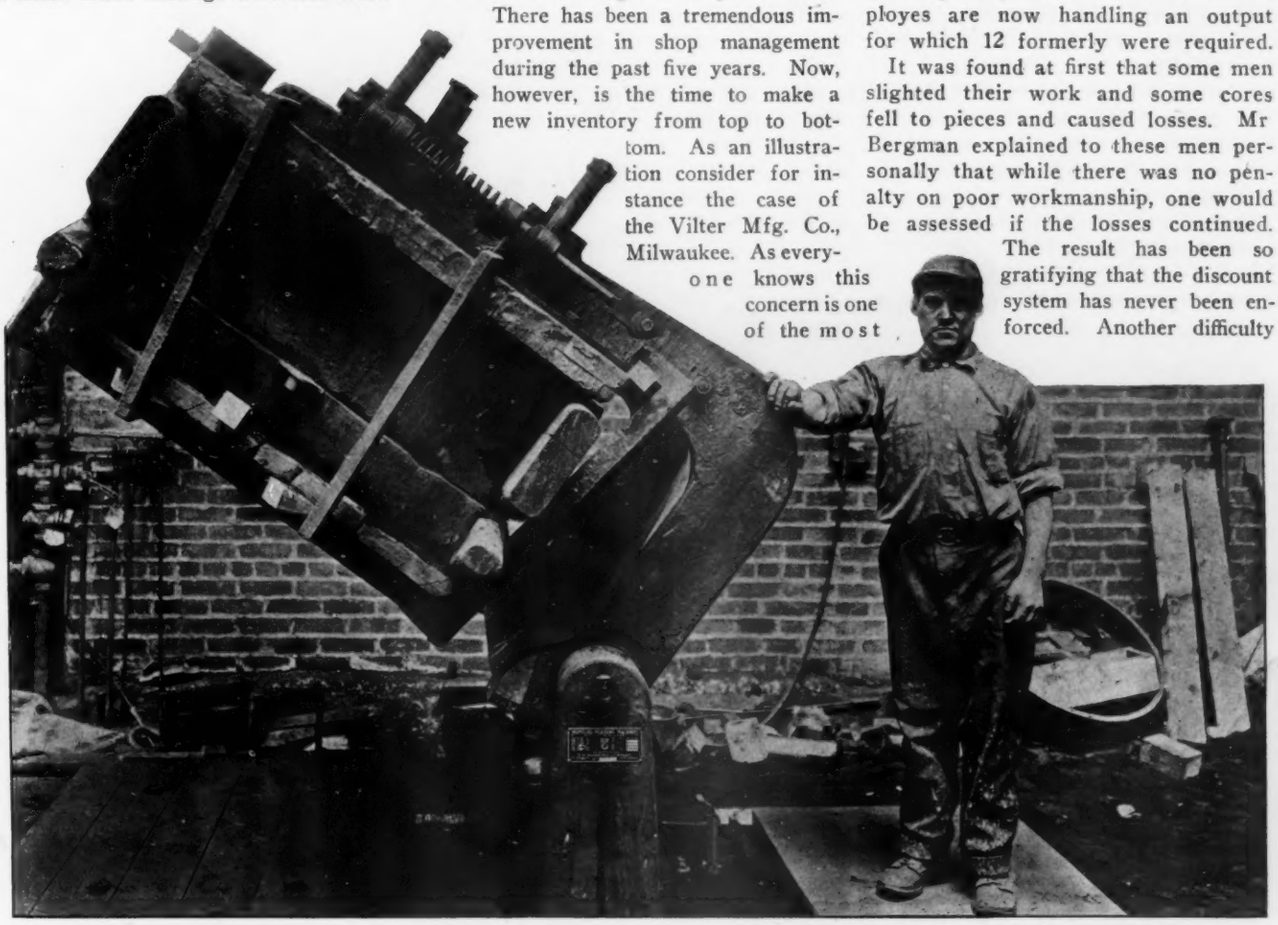
Another method of saving manpower lies in the adoption of approved systems of laying out and routing work, paying wages and supervising shop operations, all of which may be summed up in the well-known phrase, scientific management.

"But," you say, "we've been studying this problem of management for years. We have read everything on the subject we could lay our hands on. We have employed cost experts and efficiency engineers. When it comes to management we can say with confidence we are at the head of the procession.

In a large measure the foregoing statement is true in a great many foundries. There has been a tremendous improvement in shop management during the past five years. Now, however, is the time to make a new inventory from top to bottom. As an illustration consider for instance the case of the Vilter Mfg. Co., Milwaukee. As everyone knows this concern is one of the most successful in the foundry business in the middle west. The foundry of the Vilter company employs about 125 men. Some time ago Fred Bergman, foundry supervisor at the Vilter plant, foreseeing that the shortage of labor will grow progressively worse as the war goes on, set about to study the manpower problem. Looking over the ground in his own shop which was already pretty thoroughly organized, he conceived the idea that labor efficiency could be increased by applying the premium system, originally advocated by such eminent engineers as Taylor, Gantt and Halsey.

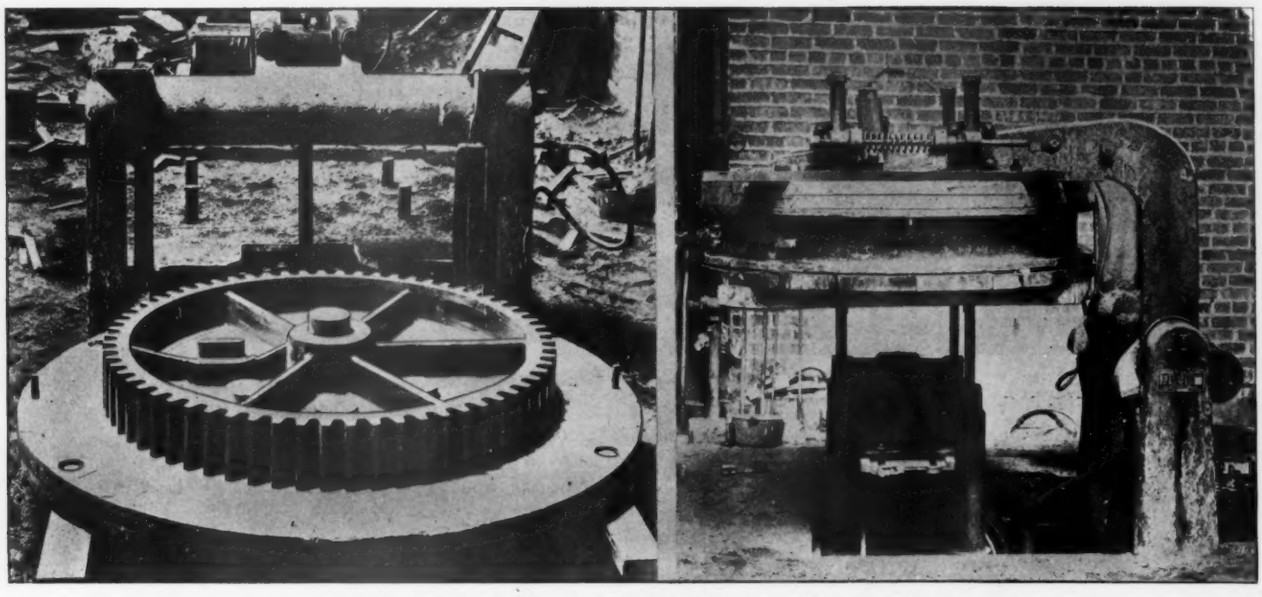
In spite of its success in other lines, the premium system has never obtained much of a foothold in the foundry business. Mr. Bergman, therefore, found himself doing pioneer work. The coreroom was selected as the place to make the initial installation of the system. The work in the coreroom was carefully analyzed and a standard time was set for each standard job. The men are now paid on an hourly basis and in addition are given a premium of 50 per cent of the time saved. The premium card used to check up the work is reproduced on page 449. As a result of this system, seven coreroom employes are now handling an output for which 12 formerly were required.

It was found at first that some men slighted their work and some cores fell to pieces and caused losses. Mr Bergman explained to these men personally that while there was no penalty on poor workmanship, one would be assessed if the losses continued. The result has been so gratifying that the discount system has never been enforced. Another difficulty



A STUDY IN CONTRASTS—MANPOWER VS. MACHINE-POWER

How puny is Tony in comparison with an enormous jar-ram roll-over machine—With the help of the machine, Tony and his partner can do as much work as six men by hand—four more soldiers for Uncle Sam



MANPOWER CAN BE SAVED BY USING MACHINES TO MOLD BIG GEARS

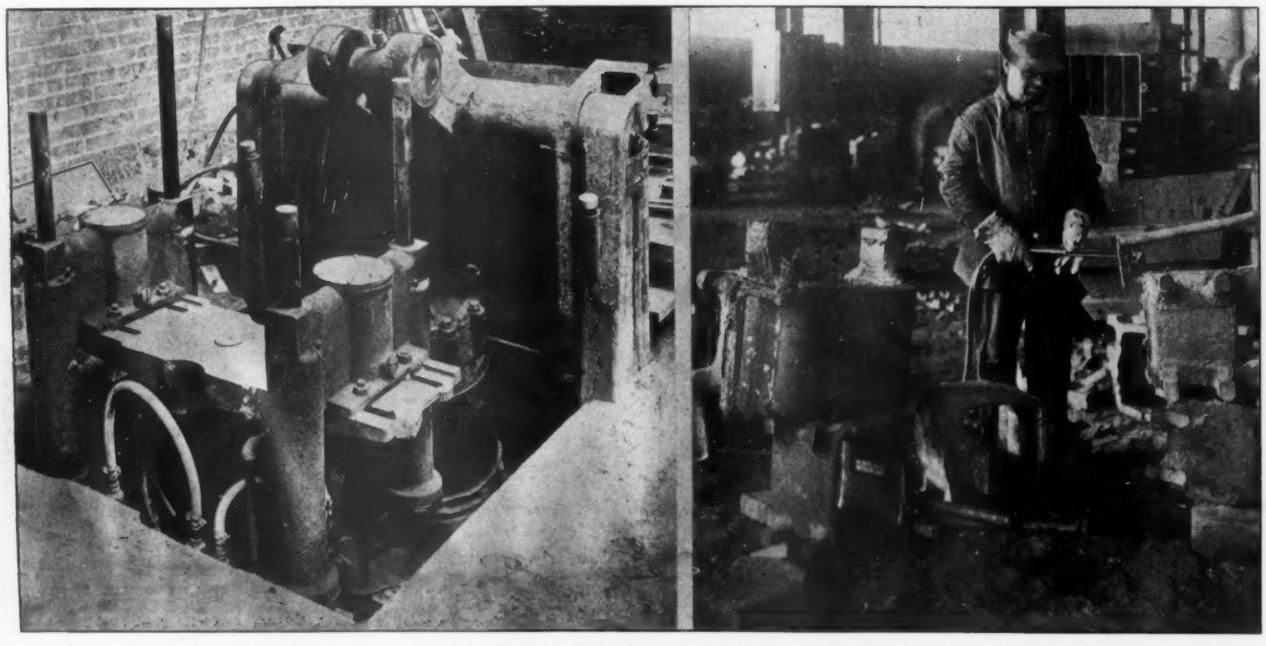
arose, however. Coreroom employes became too prosperous and began to drop out for a half a day or a day at a time to spend their surplus. In the meantime the system was extended to the foundry floor with great success. The foundry supervisor stated the case frankly to the men who practiced laying off. Not only did he point out that it showed lack of patriotism, but he also said, "We rent you your place on the foundry floor just as your landlord rents you a house. If you don't occupy it and take care of it, we will get another tenant." Absences have since been reduced to a minimum.

The Vilter company has learned, however, that the man who drifts from job to job does not work satisfactorily under the premium system. Its best results are obtained with steady-going men who appreciate their responsibilities. Nevertheless, scientific management does save labor.

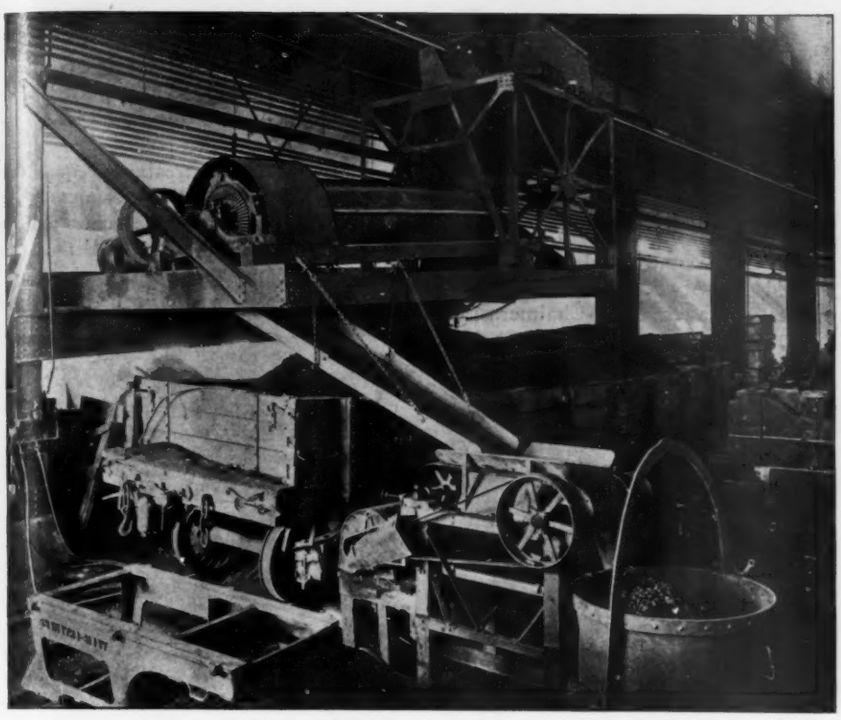
Most foundrymen, however, will find they can make the greatest headway against the manpower problem through the substitution of machines and mechanical methods for handling work. In spite of the tremendous progress of the past few years in this direction, there is still a big opportunity for further advance.

The foundry superintendent who earnestly and patriotically desires to release as many men for the army or for other essential industries as possible, will study the problem earnestly from the standpoint of the substitution of machine power for labor power. It will be found, too, that exemption boards will take the position assumed by the fictitious Morgan in his conversation with George Sinclair of the Brownlee foundry. The fact that the industry is essential, is no guarantee that all of its employes are indispensable and where a change in methods will release men for the army or other work, we probably will find before the winter is over that the necessary changes will be enforced, if required.

The problem, furthermore, is not going to dissolve with the end of the war. There is every indication that a social revolution is in progress all over the world and it will be diffi-



AT THE LEFT, SELF-LEVELING DEVICE FOR GEAR-MOLDING MACHINE—AT THE RIGHT, THE CUTTING TORCH IS FASTER THAN THE SLEDGE AND CHISEL



THIS SAND RIDDLING AND SEPARATING APPARATUS SAVES THE LABOR OF TWENTY MEN

cult indeed to induce returning soldiers by the millions to go back to their normal occupations under some of the conditions which existed prior to 1914. *Engineering*, one of the most prominent technical journals in Great Britain, in its issue of July 26, sums this phase of the question up in the following language:

Develop Human Production

"Primarily the wastage of war must be made good. To obtain the desired end, there must be no restriction of effort. Shorter hours and increased wages can only be afforded if the result is justified. However, where long hours and low wages prevail, since human energy is a fixed quantity and not proportional to time worked, the results inevitably will be meager, the means employed primitive and the profits strictly in ratio. Where, on the other hand, high wages and short hours or both are worked, there is an abiding incentive to employ the worker economically by aiding him with every device that ingenuity can suggest. The justification for the machine is that it multiplies men, and the aid of mechanism should ultimately set men free from bondage and all the worst features of toil. Also for war purposes, a vast reservoir of unutilized labor has been tapped; thousands are working to provide for their own wants who hitherto were an unproductive burden. It would be folly to scrap this potentiality and to shift the burden back again on fewer shoulders. We have learned to limit our wants, and before hostilities end we may have to cut our necessities to a bare minimum. In other words, the practice of economy is not optional. With the restoration of normal conditions the practice of economy will still persist, and the claims of the nation will limit every purse.

"Finally, to gain what everyone desires, leisure and comfort in a free and democratic state, the greatest relative number of producers is necessary. Real, unrestricted effort by every industrial unit, genuine co-operation between management and man—whose real interests are identical, not opposed—a more intensive application of mechanism to industry and improved methods everywhere are demanded. This program will serve not merely to liquidate an immense war burden, but in the course of time it should enable every industrial unit to have a rational life with some provision against contingencies."

Examine Every Corner of Your Shop

There is hardly a department in any foundry in which some improvement in equipment will not save labor. The superintendent or manager who is anxious to attack the problem consistently will examine every corner of his establishment.

Perhaps half the energy in a foundry is expended in handling materials. Here alone lies a field full of big possibilities. Taking into account the number of times each pound of material must be rehandled, we find that an ordinary gray iron foundry turning out castings of medium size, such as automobile cylinders, handles the equivalent of 20 to 25 tons of iron per ton of good castings produced. The weight of sand handled is even more, ranging from 30 to 40 tons per ton of good castings. Many foundries handle 9 or 10 tons of core sand alone for every ton of castings produced. Altogether the average gray iron foundry handles 60 to 75 tons of material for each ton of castings produced. The possibilities which lie behind even a small unit saving are evidenced from these figures. Take for instance the question of using grab buckets for handling sand and cleaning up floors. One such bucket has displaced as many as 25 men in a foundry.

The opportunities for saving labor through the use of molding machines

PREMIUM CARD

Article No. P.

Drg. No. Pat. No. Desc. No. Date

For Order No.

OPERATION	ACTUAL TIME	SET TIME
TOTAL		

No. Wanted	Time allowed
No. Made	Time taken
Clock No.	Time saved
Tool No.	Prem. 50%

THE PREMIUM SYSTEM SAVES MEN BY STIMULATING OUTPUT

are almost legion. Consider for instance the problem of gear molding. On account of the large amount of unsupported sand between the teeth, it has always been difficult to mold gears on machines. Stripping plate machines, of course, can be used but they require a special plate of the proper size for every size and type of gear.

Machines of the template type for molding large gears also are successful, although only three or four teeth can be molded at one time. Progressive foundrymen, however, have found it possible to mold large gears with ordinary pattern equipment on jar-ram, roll-over machines. The illustrations on page 448 show how this is done on a machine built by the Dayton Molding Machine Co., Dayton, O., formerly the E. H. Mumford Co., Elizabeth, N. J. One illustration shows the wooden gear-pattern on the machine ready to receive the flask. Another shows the machine with the flask rolled over, ready to draw the pattern, while a detail view of the pressure leveling device is shown in still another illustration on the same page. Previous to the installation of the machine, a molder put up one gear a day by hand. His wages were $5.75. Adding 100 per cent for overhead, the molding cost per gear was $11.50. Using the machine, one molder and one helper puts up five gears per day, thus releasing three men for the army or other work. The combined wages of the molder and helper are $8 a day, and therefore with 100 per cent overhead added, the molding cost is reduced to $3.33 per gear. Beyond doubt, the molding machine is one of the greatest man-saving devices ever developed for foundry purposes, and the limits of its possibilities and its wide range of uses are by no means appreciated at the present time.

Save on Sand Mixing

The amount of sand which must be handled and prepared in turning out a ton of good castings has previously been mentioned. A detailed study of the sand-handling problem opens up another avenue of man-saving possibilities. For instance, take the case of machine versus hand-mixing in the core room. An investigation covering about 100 foundries conducted by the Blystone Mfg. Co., Cambridge Springs, Pa., showed that on the average, a modern core-sand mixer saves four men. In other words it does the work for which four men would be required if the sand were mixed by hand, and does it better. This means 400 men, two companies of soldiers, in every 100 foundries saved through the use of one type of foundry apparatus applied to only one foundry department.

The illustration at the bottom of page 449 shows in another form the results which may be obtained by applying gray matter to the problem of saving labor in handling sand. This illustration shows a special riddling device and sand separator designed by A. E. Harrison, assistant works manager, Allis-Chalmers Mfg. Co., Milwaukee. The Allis-Chalmers company operates an exceedingly large foundry in which a great many very heavy castings are made. Formerly, when these large castings were shaken-out, the sand accumulated faster than it could be handled by a large gang of men, who shoveled it into cars for disposal. Also, the constant shoveling from the floor kept clouds of dust in the air at all times. At present the sand accumulations are removed from the floor by means of a 1½-yard grab bucket which discharges into the hopper feeding the revolving screen shown in the illustration on page —. The sand sifts through the screen into the car spotted underneath while the larger particles are carried by a chute to a magnetic separator which picks out the iron. The refuse from the separator is finally discharged into a bucket which is removed periodically by the crane. All of the work is done at night in about 2½ hours and this apparatus saves the labor of 20 men. Even in this war, 20 men in a strong outpost may constitute the decisive factor in an important engagement.

An Old Problem in a New Uniform

The existing labor problem is indeed one that should arrest the attention of every foundryman, make him sit up and take notice, put on his thinking cap, delve down into his pockets for funds, work to save manpower, and thus do his bit to win the war. Man is puny. Machines are mighty. Let machine power do the work of your absent soldiers.

At the same time, none of us should lose sight of the fact that the task of conserving manpower is much broader in its scope than is implied merely by the substitution of machines. The men we retain in the shop—and there will be many—must be employed with maximum effect. In brief we have before us in a new uniform the age-old problem of industrial efficiency. Stated in another way, it is simply the problem of obtaining more results with less effort, and on its successful solution depends the further progress of our material civilization.

Will Install Heat-Treating Plant

The American Metallurgical Corp., Franklin Trust building, Philadelphia, has been awarded a contract by the aircraft division for the installation of special electric heat-treatment equipment in the plant of the Ohio Seamless Tube Co., Shelby, O. Airplane tubes will be heat-treated and it is hoped that the efficiency of the tubes will be increased by this treatment to such an extent that a large amount of weight will be saved in the construction of the planes and allowing also for the general increase of efficiency throughout. The heating units to be installed are to be supplied by the General Electric Co., Schenectady, N. Y.

Steel Men Wanted

The metallurgical branch of the ordnance department, engineering division, under the direction of Dr. George W. Sargent, is seeking a number of men for important metallurgical work. Men who have had steel mill experience, or its equivalent are desired. These men are needed at an early date. Suitable salaries will be paid. Requests for further information should be addressed to Lieut. Col. H. W. Reed, office of the chief of ordnance, engineering division, Washington, D. C.

Organize Equipment Company

The Tool & Equipment Co. has been organized with headquarters at room 1858, 50 Church street, New York, to sell machine tools and general equipment. This company also will serve as eastern agent for the open-hearth furnace built by the McLain-Carter Furnace Co., Milwaukee. B. F. Lively, formerly manager of the Lenoir Car Works, Lenoir City, Tenn., is the head of the Tool & Equipment Co.

Inaugurate Core Oil Plant

The Holland Core Oil Co., 2012 Austin avenue, Chicago, has placed in operation a new plant for the manufacture of core oils. It is modernly equipped throughout and it is designed to insure continued uniformity of product. The buildings are of fireproof construction and the warehouse in connection with the plant has a storage capacity of 5000 barrels. The output in one shift of eight hours is 114 barrels.

The Charles T. Topping Machinery Co., 411 Fulton building, Pittsburgh, has merged its interests with the Pittsburgh office of the Lakewood Engineering Co., Cleveland, manufacturer of plant and industrial haulage.

Mounting Pattern on Plates an Aid to Molding

Various Methods Are Described and Their Advantages and Disadvantages Are Discussed from the Standpoint of Both Patternmaker and Foundryman

By R R Clarke

PLATE mounting is defined as the grouping of patterns on a plate to increase output. Suppose a foundry has 100 valve bodies to make and sufficient patterns are furnished to fill a flask, say for example, five patterns. That implies 20 flasks, a conservative day's work for the average molder. That molder is paid, say $6, thus making each flask cost 30 cents and each casting, 6 cents molding cost. Duplication is not assured and therefore, would it pay to mount? That depends on mounting method, ready material and relative status between machine and hand molding. Considering these factors on the average, the mounted plate will cost perhaps $5 and common sense closes the argument, since the mounting expense is almost equal in amount to the hand molding cost.

Suppose further that the castings are wanted in a great hurry. Hand molding implies a full day, machine, perhaps an hour or so. But it will take time to mount and test the accuracy. Besides, cores will have to be made, safely at least a half day for the lot of 100. The molding operation would scarcely be started until uninterrupted machine procedure could be established for completing. What gain of time would then ensue, since the molder could start at once and proceed straight on a supply and demand core basis? Then, too, one thing ought to be reasonably certain, that your molder will encounter little difficulty getting the molds and their castings, something you cannot always depend upon with the first attempt with the machine. These and other related considerations would doubtless determine it good policy to drop the mounting idea. Conditions are possible, however, under which the thing might pay. We might cite an actual instance. One hundred and fifty stuffing box glands were wanted from six patterns that were furnished. Order and pattern reached us late in the afternoon. Cores were at once made and the patterns mounted by the mold-to-plate method on one of the blank plates always in reserve for such a purpose. Accuracy of mounting was tested from a solid mold poured from lead. By snap-flask, squeezer-machine method, the castings were obtained early in the forenoon of the following day, representing a substantial gain in both time and expense. The number of castings initially ordered and assured duplication, are not always determining factors of profit. Each individual instance embraces many considerations of distinct bearing. In considering the advisability of mounting, mere calculated difference of molding costs cannot be regarded infallible. Often they are most fallible by virtue of related conditions such as relative casting status, casting loss, metal waste, increased draft, core complement, cost of cleaning, number of patterns accommodated, etc. This latter consideration can well be taken to illustrate. Every foundry working machines observes a distinct size or several such sizes of flask for the purpose. These flasks, in many cases are used exclusively on machines. They set definite limitations on the pattern sizes. Different cases arise where a machine flask will take in three patterns when a hand flask, but slightly larger or differently shaped, will accommodate four or five or some other differing ratio. Thus, one or more patterns accommodated, by virtue of duplication and by gate metal saved, often will equal all the advantages gained through machine rapidity in producing the molds. If the ratio be 2 to 1, it is readily apparent that the machine will utilize almost double the gate metal and will be compelled to produce twice as many molds to attain the same casting output.

Machine Enthusiasm

There is such a thing as machine enthusiasm which, like all other brands of enthusiasm, can be made a dangerous as well as a useful asset. It is that spirit which prompts the conviction that any pattern for which a machine will make a mold is the best way to make it. That is true providing the machine makes the best type of mold in the best type of flask. Otherwise it is doubtless untrue. A case in mind is that of a heavy blank gear wheel running well into the cope of the mold. The type of machine was the jolt-squeezer with the snap-flask. Here was a heavy casting to be made of 88-10-2 metal and naturally requiring strong gate pressure. To this the solid iron flask logically applied. Certainly it was sadly out of place in a snap mold protected only by thin, elastic bands forming imperfect, weak joints. The verdict of practice was exactly what common sense might have dictated. A decent casting was never made from that plate. Those given requisite pressure were abnormally swollen, while those limited to mold resistence invariably shrunk.

Another case also bears reference. Plate-mounted for the same snap-flask were two bushings vertically molded and making their own core. Dimensions approximated 7 inches deep, 7 inches on the outside and 6½ inches inside diameter. The molds were top-gated, jolted and squeezed and the pattern-plate was hand lifted with vibrator aid. Snap guides disengaged simultaneously with pattern clearance, frequently resulted in a torn and useless mold. Again, pattern depth made casting swelling extremely liable. Further jolt-ramming to proper outside density superinduced scabbing hardness on the inside as the result of narrow metal dropping space. The first time we saw that pattern worked, practically every casting was lost. Common sense clearly indicated the folly of this procedure, but machine enthusiasm was high and a departure from this method was opposed. To make the best of a bad case, two wooden blocks were sawed out and set in the core-space of the patterns while jolting the outside sand and these were removed for inside jolting. Fair results followed, but at so great a sacrifice of time as to still leave the machine idea beyond the domain of common sense.

The author's experience is, that within its limit of capability, the green sand core holds prestige over the dry sand core. But the latter frequently replaces the former. That of course is perfectly legitimate provided it yields a real credit balance. The great cost of the dry core, the metal it will absorb, the more difficult job of cleaning it entails and other details will always challenge judgment on its advisability. Besides, casting quality may suffer indirectly from it. An example is the core for a spanner or coupling nut, which always had been molded vertically. To mount the pattern on a machine, they were made to cast horizontally, using dry sand cores. Everything seemed all right until complaints started to come in about many spanner nuts breaking in hand wrenching. Investigation showed the weakness on the cope surface and at once disqualified that process of machine molding for this particular job.

Many cases arise, however, where the dry core, at eminent all around advantage, will favor machine molding. A single instance will demonstrate. Recently we took an order for a large number of thin-walled, square boxes to be used in the United States postal service. In the end-centers of these boxes were in-striking lugs. By hand molding these lugs came from a drawback, something out of the question with the machine method. Small core prints running from the top mold side of the box to the lug positions solved the question admirably. By them a very small end core, practically a stop-off core was all that was needed to realize the center lugs. As already acknowledged, the dry core is a full-powered factor to machine possibility. But the question is, is it, in all respects an undisputed paying factor? To employ it in utter disregard of this logic and merely to machine-mold is a policy with which common sense can have little to do.

Machine-Molding Limitations

Every type of pattern and practically all makes of machines have set limitations arising from a variety of governing conditions. A tendency of modern founding, more or less universal, is to overstep these limitations. A few general instances will suffice for illustrative purposes. Nothwithstanding pouring method or temperature, there is a limit to metal-running capacity. Very often small, light castings are ordered in large numbers. The average foundryman has no preference for that class of work, yet he feels obliged to consider it since from the same source arises also the greater tonnage casting. On the light casting, the hand method is distinctively a losing proposition and machine-molding is the natural trend. The dominating influence is to approximate the uttermost limit of flask capacity. Now flask capacity is not always metal-running power. Suppose you have a casting weighing two ounces. Comfortably admitting 30 patterns to a flask and with an output of 100 flasks per day, averaging 3¾ pounds per flask, the daily output is 375 pounds, which is a low tonnage. Now if you increase the number of patterns to 40 you naturally calculate to a 500-pound output which looks much better. But suppose it is a 12 x 16-inch flask and to increase your output you move toward the edges, employing additional runners and crowding the patterns closer together. And suppose by this moving and crowding you force to 50 inches linear of running and 40 inches spreading or delivering gate measurement, then the common sense question is this, will the metal, under practical conditions, faithfully and properly fill all the pattern molds? Of course, under experimental conditions it may give sand castings, but will it in every-day practice where identical conditions cannot prevail? How many castings will fail to run properly.

In running light castings it must be understood that pressure and resistance are the great assets which must coordinate a live metal temperature if satisfactory results are to be looked for. To fill the runners at once and to keep them full under pressure is the proper method of faithfully spreading the metal. But you cannot do that where the field is too large or the distance too great. Neither can you accomplish it where the gate is too large. Recently we mounted four cup-shaped, eight-ring patterns that filled the flask. Sometimes three castings ran, sometimes two, but never four. We took one pattern off and reduced the field to a minimum with the result that only a very few castings now fail to run. Incidentally we have revised our opinion of the common sense we initially exhibited in this individual instance. That a filled mold is no evidence of a solid casting is a well known foundry fact. In light, thin castings and especially those of circular or cylindrical form, the proper union of metal is a primary essential. Such unions cannot be relied upon in the super-expansive pattern field. A foundry making thin-walled bushings on end has many pattern plates representing a field over-crowded and excessive metal-running capacity. These bushings are broached in the machine shop and include many castings breaking in the operation. At least 50 per cent of these broken castings show a longitudinal fracture line, indicating plainly a most pronounced, imperfect metal union.

Results of Crowding

From over-crowding the field, other consequences can arise which surely will advise against it. Among these are the breaking together of castings and run-outs resulting from close proximity of pattern to flask edges. Further related, though indirectly, is the practice of using flasks and plates of excessive surface area. Especially is this true in the squeezer type of machine. The flexibility of plate surface increases with area and the consequence of overdoing the thing is bad-drawing patterns and castings to greater or lesser degree out of proportion to the patterns.

All mounted plates may be said to be either of the temporary or permanent type. Between the two is a wide foundry distinction. The former applies to castings ordered in such numbers and of such a type as to justify machine-molding, yet they are of transient demand only. The permanent plates, of course, are made for castings frequently duplicated. It is evident that the same mounting and expense is not good logic. In temporary cases, patterns can be of that kind of material and attached by that method only as will last out the temporary service. Very often wooden patterns of the cheapest grade will suffice and will retain their position by merely being tacked on a board. In the instances of permanency, however, no such thing can be countenanced. It's not what you pay for an article, but what you get from it that counts—not how long it takes to do a thing, but through what time and service that doing will last.

Permanent Plates

Here we enter the critical phase of the subject involving material and endurance in plate mounting patterns. The wood board, the wood pattern, the loosening tack or brad, the soft-metal flask pin hole, etc., are no longer logic. These are perishable things. The steel or aluminum plate, the metal pattern, the machine screw and rivet, the core-hardening bushing, etc., become the demands of the situation. The plates may be made of boiler steel, from ⅛ to ¼ or ½-inch in thickness, according to the demand of the individual case. They should be surface flattened and then surface ground. Or they may be the alloy, 92 aluminum and 8 copper. Pure aluminum is too flexible for the average core, while the aluminum zinc mixture is excessively brittle. Added to this is the possibility of a rough surface in the drag half of the pattern caused by zinc liquation. These plates can be cast in sand or dies and subsequently planed to uniform thickness and strict level surface. Pin holes can be accounted for either by the in-set bushing or the cast-in steel disc. On certain types of machines, as the jolt for instance, provision against the battering effect of the flask edges should be made. Steel cast into the metal will be found valuable. In those cases where the wood board is resorted to for permanent work, it should be given the same ample protection. As for the cast iron plate, we have found it unsatisfactory chiefly on account of the excessive bulk and weight for the average purpose. On the rigidity of a plate, much of pattern-drawing tendency and of its position retaining power depends. Screws or rivets will soon loosen and give constant annoyance on a thin, flexible plate subjected to constant surface pressure in opposite directions, as on the squeezer machine utilizing the snap flask. Patterns consequently loosen, fail to draw properly and often shift. A common practice in eliminating a shift is to examine the castings on the gate, locate the out-of-position parts and with a hammer and wooden block drive the offending pattern halves that direction and to that extent indicated by the cast gate. Nothing is more probable

than that the driven parts will eventually go back to their former positions. To guard against this we find it an excellent plan to temporarily screw the pattern halves to the plate, make a test gate, correct any evils exhibited, test finally and then fasten the patterns. To accomplish this, holes are drilled at at least two points entirely through the pattern halves and the plate and countersunk on either side. Neat fitting iron pins are then driven into these holes and riveted tight. To the through-and-through riveted pin we attach our faith in holding metal patterns to metal plates. The strong power of the vibrator to loosen the screw becomes all but impotent in attacking the rivet.

In plate molding, good pattern clearance and absolute perpendicularity of descending pattern, parts are prime requisites to a neat, substantial mold. The vibration is sometimes misunderstood. It is scarcely a pattern rapping device. Its function is not so much to enlarge the pattern mold, but rather to constantly disengage pattern bordering sand and to aid in straight lifting. This is evidenced by the fact that a vibrator operating at right angles to the plane of the pattern field, in the average core, will give as good results as if operating in a horizontal position. Now the argument is not for excessive pattern draft. That is by no means necessary and can and should observe an absolute minimum. The great essential is, however, that strict unformity of surface in pattern-drawing directions should be faithfully realized in finishing patterns. Over hollows, bumps or back-draft in a pattern, the vibrator exercises little if any control and a disturbed mold can always be looked for. One of the chief values of the mounted plate is to yield a clean, clear cut mold in every detail.

Testing the Plate

A molding error by the hand method may result in a single defective casting; on a mounted plate, 100 or more such castings may materialize. We have always leaned strongly to the idea of testing out a plate before doing regular service, testing it not only for matching accuracy, but also for those many and often invisible casting defects that may arise from erratic molding judgment. To this end we have sawed gates off close to the casting; had castings turned up and even tested. Sometimes it appeared an expensive proposition, yet we are convinced of a common-sense license to it. One thing we know is that we have several times found hidden evidence of illogical practice and doubtless escaped lots of trouble by at once correcting it.

Pattern material is important. In the wood pattern we have nothing except transient interest. They possess practically no capacity to stiffen the plate and at best are mere, temporary affairs. Such only is their field, and even in that by representative machine service their powers of resistance all too often are exhausted. The metal pattern is the natural escape. Brass, white metals and cast iron possess the stability and subserve the purpose, though at the sacrifice of lightness in weight. When used the greater the bulk that can be eliminated and the thinner the walls of the shell pattern within practical limits, the greater the manipulating advantage.

Why Aluminum Plates Are Preferred

Outranking all for the average purpose, however, is the aluminum or the aluminum base alloy. The pure product is none too low in plasticity and flexibility and concedes an advantage in a harder and more rigid modification. Zinc or copper are the alloying possibilities. The former admits the disadvantages of brittleness and rough surface handicaps from which the latter is happily exempt. Copper, 8 and aluminum, 92 we have found quite satisfactory. To realize the best results in pattern appearance and quality, it is essential that the alloying be properly executed which means to melt the aluminum and slowly add the copper in very thin, clean clippings. Foundries not familiar with the casting of aluminum and aluminum base alloys will do well to enlighten themselves on the subject before casting for pattern purposes. It is no difficult matter by the melting, molding and pouring to produce castings undersize, porous, shrunken and full of cavities which represent conditions with which a good pattern can have nothing to do.

Metal patterns should be well finished to absolute uniformity and smoothness of surface. Some patterns are of that shape and size as will permit this to be done handily. Others are not. In extreme cases, it is sometimes common sense to cast patterns in parts and after finishing the parts, to assemble them separately. A case in mind is that of a small goose-neck pattern including a ribbed flange. The ribs, the flange and the neck were all cast separately and after finishing, they were pinned together giving an appearance and an efficiency to the job not otherwise possible. It is generally conceded that wood is easier to work than metal. When a wood pattern produces a metal pattern abnormally in advance of calculated size, it is sometimes a sensible thing to reduce the wood pattern and recast rather than to work the metal pattern down to size.

In attaching patterns to plates the advantage of a close surface-seat can hardly be over-estimated. Patterns not seated fairly and squarely on the plate may be thrown out of line in lifting direction resulting in torn molds while those admitting space between plate and pattern edge, invariably result in ragged mold edges. For this reason we have found it a paying practice to slightly undercut broad resting surfaces in the pattern, thus making sure of a close edge fit.

In this same connection arises the question of attaching gates to patterns. It is at once plain that at point of union with the pattern the gate should admit absolutely no intervening space. To realize this, different methods are employed. About the best we know of is the soldered joint co-ordinating a very neat fit. Of the less dependable methods none is more demonstrative than the wax-filling. It is the more prominently failing when applied to the metal pattern. These fillings are usually a combination of bees-wax and some hardening substance such as rosin or plaster of paris. Between them and the vibrator is a short-lived fight eminently favoring the vibrator. All in all, the great idea in finishing patterns and applying them to plates is an absolutely clean and undisturbed mold made in the minimum amount of time. If machine molders have to patch, wet down, or hook or blow sand out of molds, the job may just as well be given over to hand methods.

Accuracy Essential

In machine molding everything depends upon mechanical principle and accuracy. The mounted plate requires much auxiliary equipment which by constant use, constantly calls for repair or renewal. This equipment includes such parts as pins, bushings, vibrators, snap flask guides, rubber hose, electric wire extensions, switches, etc. There is no sense in waiting until these parts are worn out before making repairs. Reserve parts in repair, should always be kept on hand. If you have six machines you should have eight or ten vibrators and other parts should be provided in equal number. In this connection standardization will effect economies. Nothing but inconvenience results from having a vibrator fit one plate and not another simply because bolt holes in either vibrators or machine plates were drilled more or less at random. In different foundries the author has seen many mounted plates. One thing that often impressed him was that no attempt had been made to observe uniformity of the position of the button gate, which of course determines the position of the drop gate or sprue.

In the average case this sprue is pipe-punched, the machine operator either guessing or roughly measuring about where it should be. If in mounting different plates some attempts were made to standardize location, the punching of the sprue would become much more

simple and accurate. A case we remember was of two plates that contained four small bushings lying sidewise across the field. In the one case the sprue was in the middle, in the other, at the end. Why the difference is still a puzzle.

Practically every type of pattern has a molding peculiarity more or less expressive, some little or more marked

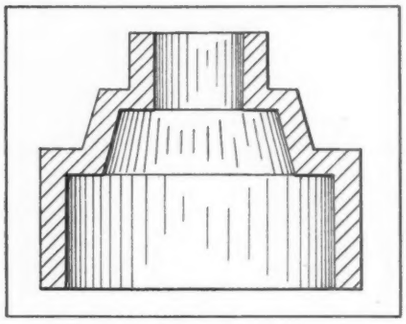


FIG. 1—SKETCH OF A CAP NUT

variation to be observed in the tamping, venting, pouring temperature, etc. These pecularities are often learned from the casting results and are then understood. In different instances it is well to make a record of this by briefly stencilling or placarding the plate. The idea is especially applicable in the power-squeeze and jolt type of machine. Plates, for instance, yielding good castings under five jolts, 30 pounds air pressure squeeze, can be stencilled briefly to that effect and subsequent operations can be put on a sure, scientific basis.

Mounting Methods

It might be said that there are two distinct methods of mounting patterns, that by measurement and that by mold position. Of these the former is the more common and expensive. The plan is to prepare the plate and pattern parts independently and by close and accurate measurement, place the pattern parts strictly opposite each other on either side of the plate. This coincidence of position, different methods are employed, some relying on the surface gage, others the calipers, rule and square, and still others rely on the absolutely perpendicular hole through pattern halves and plate. Since all depend on mechanical accuracy for results, method is largely a matter of choice and commensurate with painstaking care for efficiency. To our mind the highest type of matching is that in which pattern parts lie absolutely equidistant from center lines drawn at right angles to each other in the pattern field. Such plates, when cope and drag halves of pattern are duplicates of each other, will make a complete mold by using a one-sided plate.

Of all patterns, the flat-back is the most simple to mount and opens a wide and paying possibility in temporary classes of work. To merely tack or screw a pattern to a board, quickly attach a gate and thereby increase output and reduce expense, is surely worth the while in even small numbers of castings ordered. If the pattern is small we tack it into some little corner on a regular service board; if large enough to justify single occupancy, we work it that way. For this purpose a strong wood-plate, well protected on the edges, is of great advantage in that the pattern can be tacked on and removed from the board in a few seconds time.

We sometimes receive patterns in which part of the drag sand extends above the flask parting surface, making two distinct parting lines, the one far up in the cope, the other on the flask edge level. Patterns having two parting lines are shown in Figs. 1 and 2. Fig. 1 is a sketch of a cup nut and Fig. 2 is a brazing flange, cast face down. A good plan to follow in mounting such patterns is to increase the height or thickness of the pattern by the thickness of the plate and to account for a

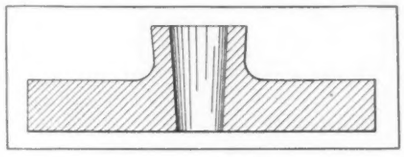


FIG. 2—BRAZING FLANGE CAST FACE DOWN

thin flange on the pattern at the outside parting level. The patterns then are cast from metal and turned to size. Holes are bored in the plate to neatly admit the pattern and allow its attachment by screws or rivets through the added pattern flange. With reference to the brazing flange, it might be recalled that casting face down is a matter of metal cleanliness and can be realized on a plate also by making the drag a flat back and carrying the entire mold in the cope. This is the easier mounting method, but complicates the molding.

At this point the stripping plate will bear mention. It is an admirable medium for clean pattern-lifting and should have thoughtful consideration. One feature of mechanical pattern-drawing that must be understood is that it involves an eminently true piece of mechanism antagonized by the most severe wearing service. In applying stripping plates it is scarcely necessary to state that the pattern must be increased by the thickness of the plate and fit snugly in it. In manipulating the stripping plate any foreign body intervening between it and the pattern plate reduces the casting by the thickness of the obstruction. This suggests the advisability of ample protection against sand and bits of metal lodging under the plate. Stripping plates cut out to a minimum of bearing surface on the underside and those overlapping the pattern plate all around are among the possibilities.

The mold method of mounting patterns involves the simple process of catching the pattern in its mold position and transferring it undisturbed in this position to the plate. Various methods of accomplishing this are open to consideration and have been previously described in THE FOUNDRY. It's all a case of matching on the plate from the matching in the mold as rammed and carries also the advantage of casting the patterns onto the plate from the mold. Its usefulness lies chiefly in its simplicity and rapidity of execution, its low cost and reasonable certainty of perfect matching.

Rapidity of Mold Mounting

A few days ago we received orders for 150 double-flanged bushings, 3 inches in outside diameter, 2¼ inches in inside diameter and 3 inches long. The patterns were delivered at 2 p. m. and the castings were to be delivered that afternoon. Three split stick patterns were hurriedly turned, each stick accounting for three bushings. Stock cores were made and dried. The patterns were mold mounted, the sand having been dug out of the one end of the flask and the patterns were locked down at this point. The patterns next were locked at the end and finally in the center. Two machine molders took the job shortly after 3 p. m. and in an hour the copes and drags were ready for the cores. The castings were de-

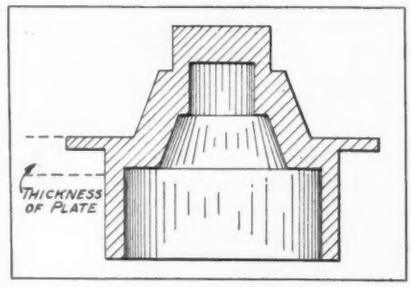


FIG. 3—PATTERN WITH THICKNESS OF PLATE ADDED AND FLANGE FOR ATTACHING TO THE PLATE

livered to the customer shortly after 7 p. m. that day. And this was accomplished in a new shop, far from being yet properly equipped and where machine molding was entirely absent and most bitterly opposed only a few months before. Significant also is the fact that the machine on which the work was done was a hand squeezer with no auxiliary equipment to facilitate procedure, employing a solid iron flask.

There is another method, or rather variation of method, of mold mounting

(Concluded on Page 460)

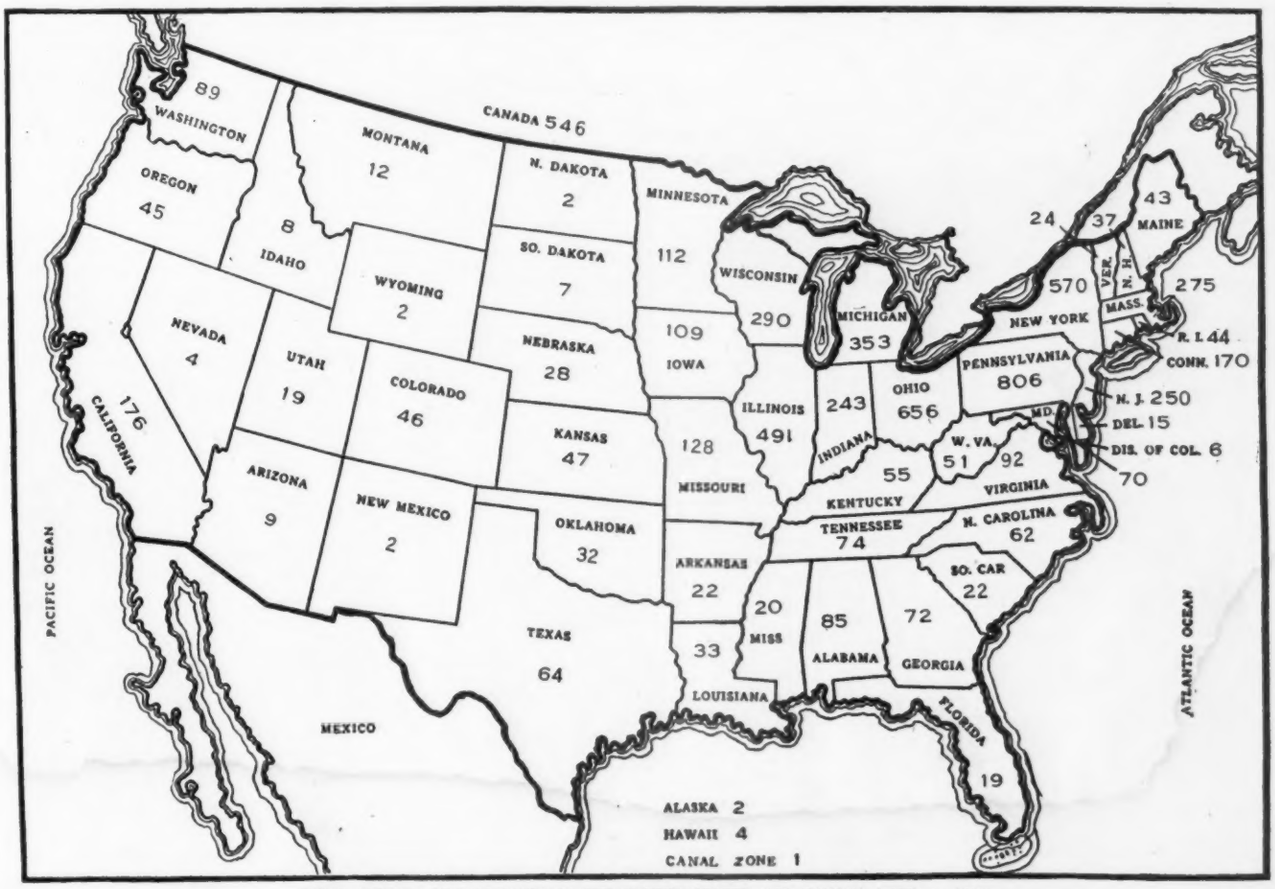
Foundry Industry Makes Big Gain in Two Years

Steel Casting and Malleable Iron Foundries Show a Big Increase and the Development of the Electric Process is Reflected by the Growth in Number of Plants

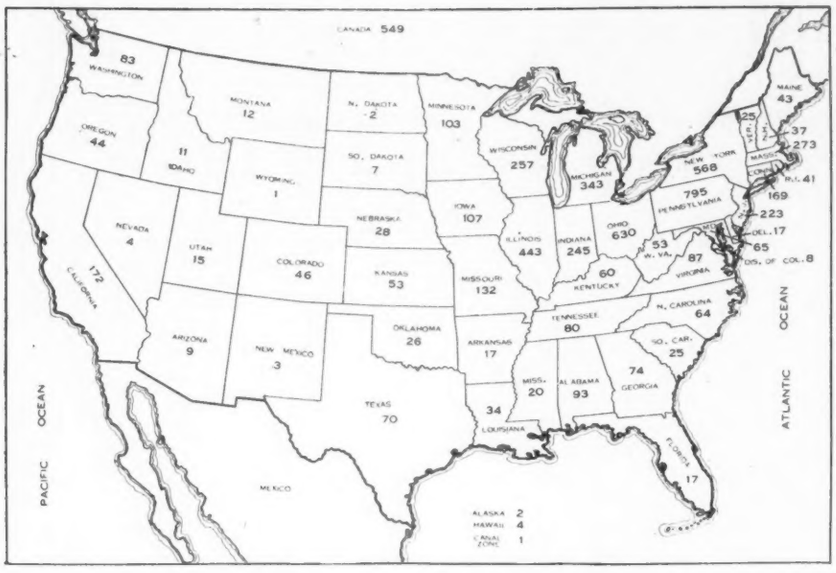
DURING the 1912-1915 depression in the iron and steel industry, the foundry trade of the United States and Canada experienced a big decline in number of plants. For example, according to figures compiled by THE FOUNDRY, 6507 shops were devoted to the casting of metals on the North American continent, exclusive of Mexico, on Sept. 15, 1914, but on Aug. 1, 1916, this total had been reduced to 6290, a loss of 207. Another survey of the foundry industry has just been completed by THE FOUNDRY and this reflects the prosperity of the past two years, since it shows a total of 6444 foundries in the United States and Canada on Sept. 1, as compared with 6290 two years ago, a gain of 154. However, the loss in number of shops as compared with 1914, when 6507 were in existence has not yet been overtaken and there are 63 less foundries in the United States and Canada today than four years ago.

Probably the most striking feature of this survey is the record of electric steel casting plants which now total 161, of which 143 are in the United States and 18 in Canada. The steel casting industry generally shows a tremendous gain in the last two years, 94 foundries having been added to the total of 332 two years ago, making an aggregate of 426 today. This represents a gain of 28.3 per cent. The malleable iron industry likewise shows a very large increase. Two years ago 213 plants were in existence as compared with 268 today, a gain of 55 or 25.8 per cent. The tremendous increase in the steel casting industry, to a large extent, may be attributed to the demand for cast steel for ordnance purposes and the activities of the malleable iron plants for several years resulted in the establishment of many new works throughout the United States and Canada.

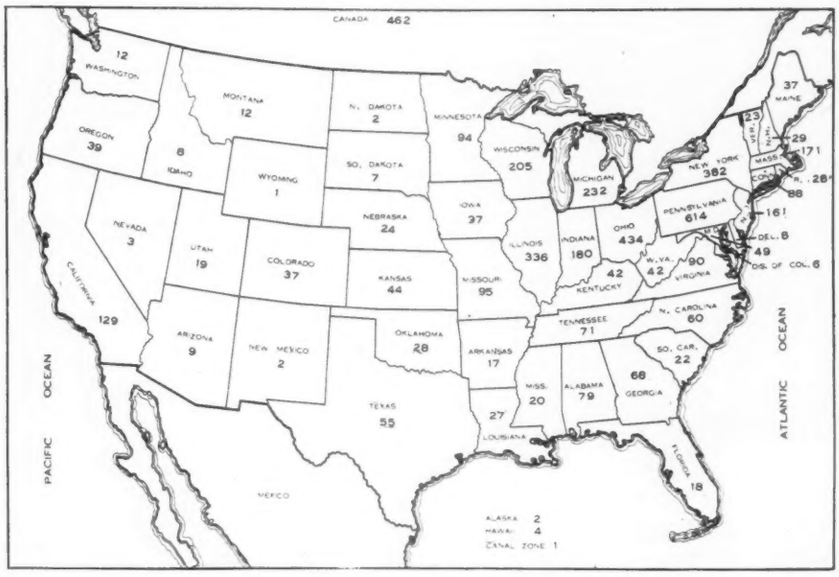
Of the total 6444 foundries in the United States and Canada, the United States has 5898 as compared with 5741 in 1916, a gain of 157. In 1914, however, 5942 foundries were listed in the United States and the total today still represents a loss of 44 over that year. Canada shows a loss of three foundries as compared with 1916. It has a total of 546 shops today, against 549 two years ago. In 1914, on the other hand, Canada reported 565 casting plants and the loss over 1914 is 19. To a large extent this decline in the number of casting plants in Canada must be attributed to this country's participation in the war which extends over a period of more than four years. Many nonessential casting plants have gone out of business and the new construction in Canada has been limited throughout the war period. Among the states, Pennsylvania is far in the lead with a total of 806 foundries; Ohio is second with 656, New York third with 570, Illinois fourth with 491, Michigan fifth with 353, Wisconsin sixth with 290 and Massachusetts is seventh with 275.



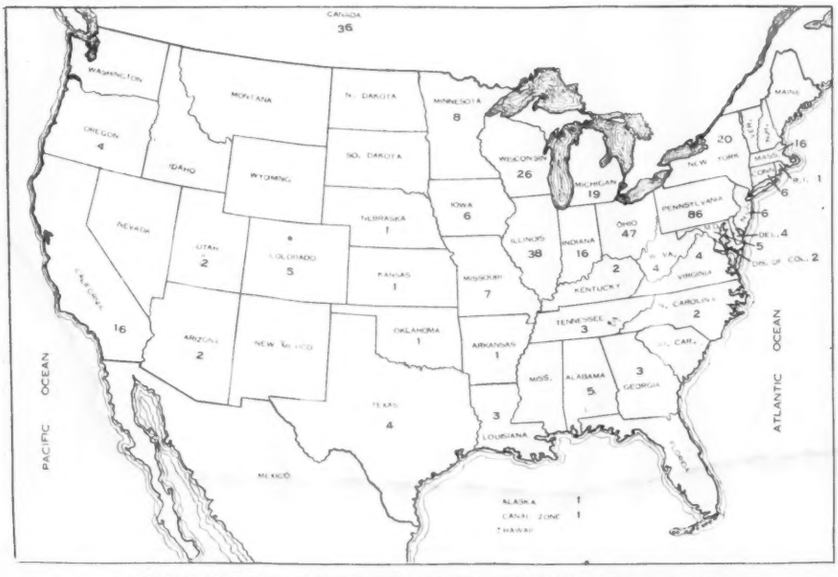
TOTAL NUMBER OF FOUNDRIES IN THE UNITED STATES AND CANADA SEPT. 1, 1918



TOTAL FOUNDRIES IN THE UNITED STATES AND CANADA, 1916



GRAY IRON FOUNDRIES IN THE UNITED STATES AND CANADA, 1918



STEEL FOUNDRIES IN THE UNITED STATES AND CANADA, SEPT. 1, 1918

The largest gain in the number of foundries was recorded by Illinois with 48, Wisconsin 33, New Jersey 27 and Ohio 26. The Province of Ontario, of course, leads all other provinces in Canada in number of casting shops with 319 as compared with 327 in 1916, a loss of 8. Quebec is second with 102 against 105 two years ago, a loss of 3. British Columbia, on the other hand, now has 27 foundries against 23 in 1916, a gain of 4.

The total number of gray iron foundries in the United States and Canada shows an increase of 63 in

Table I

Iron and Steel Foundries 1916-18

TOTAL FOUNDRIES IN THE UNITED STATES AND CANADA, 1918 AND 1916.

United States and Canada, 1918	6444
United States and Canada, 1916	6290
Total foundries, gain	154
Foundries, United States, 1918	5898
Foundries, United States, 1916	5741
Gain in the United States	157
Foundries in Canada, 1918	546
Foundries in Canada, 1916	549
Loss in Canada	3

GRAY IRON FOUNDRIES IN THE UNITED STATES AND CANADA, 1918 AND 1916.

United States and Canada, 1918	4787
United States and Canada, 1916	4724
Total gray iron increase	63
Gray iron, United States, 1918	4325
Gray iron, United States, 1916	4267
Increase in the United States	58
Gray iron, Canada, 1918	462
Gray iron, Canada, 1916	457
Increase in Canada	5

MALLEABLE FOUNDRIES IN THE UNITED STATES AND CANADA, 1918 AND 1916.

United States and Canada, 1918	268
United States and Canada, 1916	213
Increase	55
United States, 1918	249
United States, 1916	197
Increase	52
Canada, 1918	19
Canada, 1916	16
Increase	3

STEEL FOUNDRIES IN THE UNITED STATES AND CANADA, 1918 AND 1916.

United States and Canada, 1918	426
United States and Canada, 1916	332
Increase	94
United States, 1918	390
United States, 1916	304
Increase	86
Canada, 1918	36
Canada, 1916	28
Increase	8

the last two years with 4787 plants reporting the manufacture of gray iron castings, against 4724 two years ago. In the United States, 4325 shops now are engaged in gray iron casting manufacture against 4267 two years ago, a gain of 58. Canada has 462 gray iron foundries which represents a gain of 5 in two years. On the other hand, this survey shows a total of 4575 gray iron foundries in

Table II

Nonferrous Foundries 1916-1918

TOTAL EXCLUSIVE BRASS FOUNDRIES AND BRASS DEPARTMENTS OF OTHER PLANTS IN THE UNITED STATES AND CANADA, 1918 AND 1916.

United States and Canada, 1918	3472
United States and Canada, 1916	3447
Increase	25
Total brass, United States, 1918	3519
Total brass, United States, 1916	3139
Increase	20
Total brass, Canada, 1918	313
Total brass, Canada, 1916	308
Increase	5

EXCLUSIVE BRASS FOUNDRIES IN THE UNITED STATES AND CANADA, 1918 AND 1916.

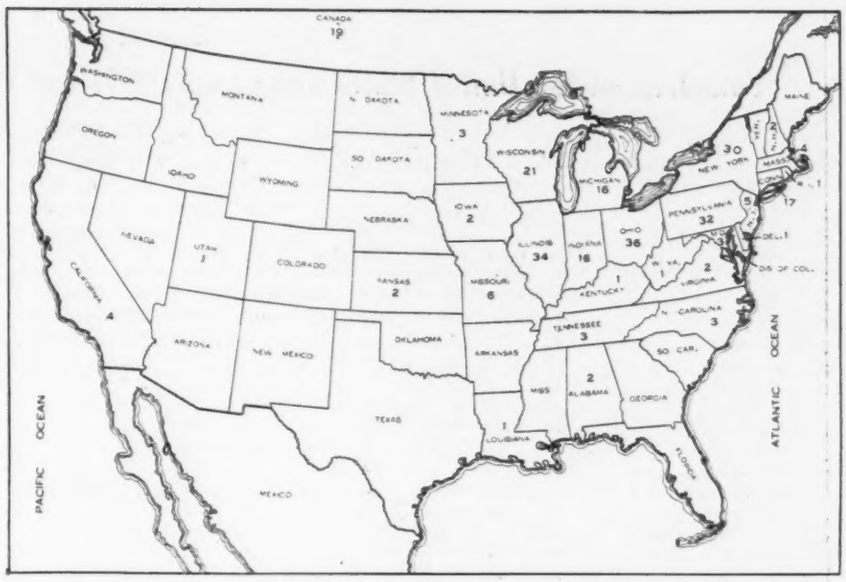
United States and Canada, 1918	1280
United States and Canada, 1916	1223
Increase	57
Exclusive brass, U. S., 1918	1218
Exclusive brass, U. S., 1916	1160
Increase	58
Exclusive brass, Canada, 1918	62
Exclusive brass, Canada, 1916	63
Decrease	1

BRASS DEPARTMENTS OF GRAY IRON, MALLEABLE AND STEEL FOUNDRIES IN THE UNITED STATES AND CANADA, 1918 AND 1916.

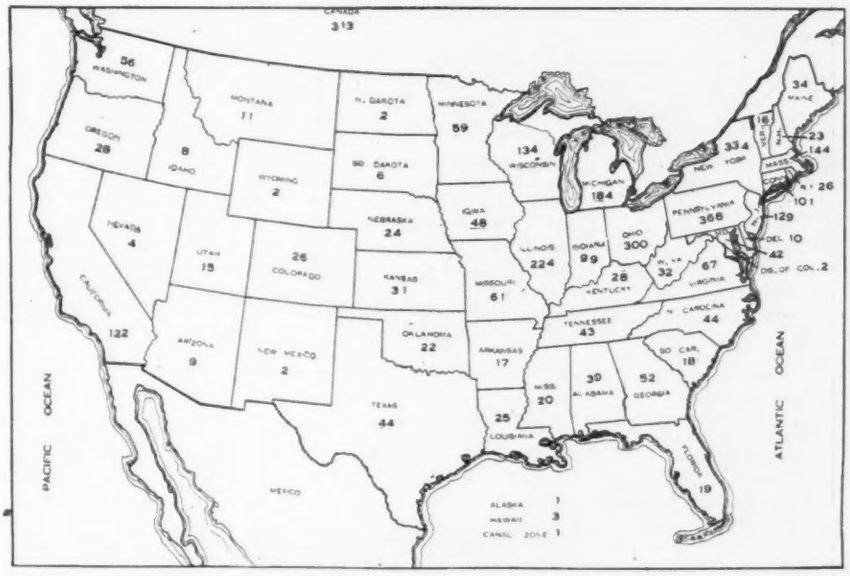
United States and Canada, 1918	2192
United States and Canada, 1916	2224
Decrease	32
Brass departments, U. S., 1918	1941
Brass departments, U. S., 1916	1979
Decrease	38
Brass departments, Canada, 1918	251
Brass departments, Canada, 1916	245
Increase	6

FOUNDRIES MELTING ALUMINUM IN THE UNITED STATES AND CANADA, 1918 AND 1916.

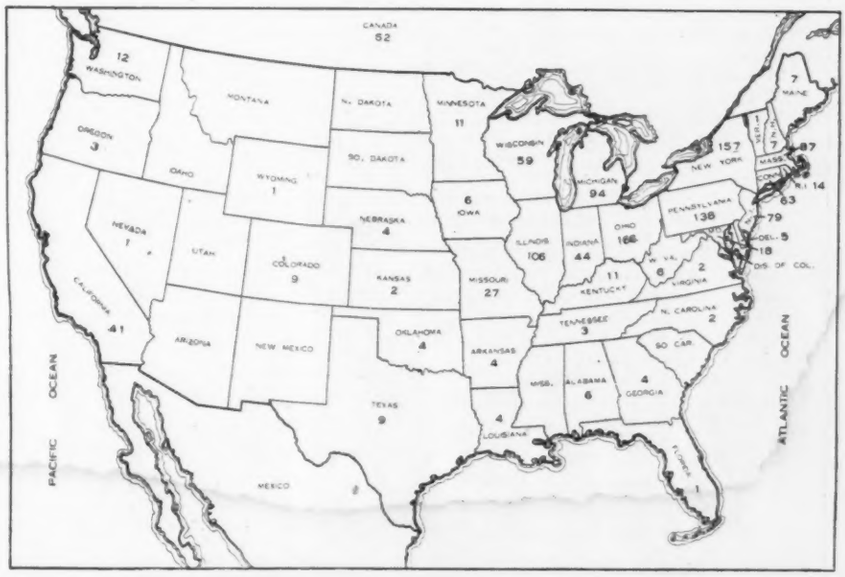
United States and Canada, 1918	2228
United States and Canada, 1916	2322
Decrease	94
United States, 1918	2037
United States, 1916	2121
Decrease	84
Canada, 1918	191
Canada, 1916	201
Decrease	10



MALLEABLE IRON FOUNDRIES, UNITED STATES AND CANADA, SEPT. 1, 1918



TOTAL FOUNDRIES MELTING BRASS IN THE UNITED STATES AND CANADA, 1918



EXCLUSIVE BRASS FOUNDRIES, UNITED STATES AND CANADA, 1918

Table III

Foundries of the United States and Canada 1916 and 1918 by States and Provinces

	Total foundries 1918	Total foundries 1916	Increase or decrease in two years	Gray iron foundries 1918	Gray iron foundries 1916	Exclusive brass foundries 1918	Exclusive brass foundries 1916	Brass foundries departments of other shops 1918	Brass foundries departments of other shops 1916	Total brass foundries 1918	Total brass foundries 1916	Malleable iron foundries 1918	Malleable iron foundries 1916	Steel foundries 1918	Steel foundries 1916	Foundries melting aluminum 1918	Foundries melting aluminum 1916	Electric steel foundries 1918
Alabama	85	93	— 8	79	88	6	5	33	32	39	37	2	2	5	4	16	16	2
Alaska	2	2	....	2	2	....	....	1	2	1	2	...	...	1	...	....	1	1
Arizona	9	9	....	9	9	....	....	9	9	9	9	...	...	2	1	5	4	...
Arkansas	22	17	+ 5	17	15	4	2	13	14	17	16	...	...	1	...	9	10	...
California	176	172	+ 4	129	130	41	35	81	86	122	121	4	1	16	12	94	92	9
Canal Zone	1	1	....	1	1	....	....	1	1	1	1	...	...	1	1	1	1	...
Colorado	46	46	....	37	38	9	8	17	21	26	29	...	1	5	3	17	20	3
Connecticut	170	169	+ 1	88	88	63	69	38	35	101	104	17	11	6	2	59	66	3
Delaware	15	17	— 2	8	8	5	5	5	4	10	9	1	1	4	5	4	4	...
Dist. of Columbia	6	8	— 2	6	6	....	2	2	1	2	3	...	...	2	2	2	3	2
Florida	19	17	+ 2	18	6	1	1	18	16	19	17	...	...	...	...	13	13	...
Georgia	72	74	— 2	68	70	4	4	48	55	52	59	...	...	3	3	26	34	1
Hawaii	4	4	....	4	4	....	....	3	4	3	4	...	...	...	...	2	2	...
Idaho	8	11	— 3	8	11	....	....	8	11	8	11	...	...	...	...	8	10	...
Illinois	491	443	+ 48	336	328	106	95	118	101	224	196	34	29	38	28	155	148	17
Indiana	243	245	— 2	180	183	44	40	55	66	99	106	16	12	16	14	65	78	6
Iowa	109	107	+ 2	97	94	6	10	42	45	48	55	2	1	6	6	38	43	1
Kansas	47	53	— 6	44	47	2	5	29	30	31	35	2	1	1	...	27	33	...
Kentucky	55	60	— 5	42	47	11	12	17	20	28	32	1	1	2	1	18	18	...
Louisiana	33	34	— 1	27	30	4	4	21	23	25	27	1	...	3	3	9	10	1
Maine	43	43	....	37	36	7	7	27	26	34	33	...	...	...	...	14	17	...
Maryland	70	65	+ 5	49	46	18	17	24	23	42	40	3	1	5	3	23	23	1
Massachusetts	275	273	+ 2	171	172	87	88	57	55	144	143	4	4	16	13	104	102	5
Michigan	353	343	+ 10	232	233	94	87	90	103	184	190	16	9	19	16	129	139	8
Minnesota	112	103	+ 9	94	89	11	11	48	42	59	53	3	2	8	4	45	44	4
Mississippi	20	20	....	20	20	....	....	20	19	20	19	...	...	...	...	9	8	...
Missouri	128	132	— 4	95	98	27	27	34	40	61	67	6	5	7	4	40	48	2
Montana	12	12	....	12	11	....	....	11	10	11	10	...	...	...	...	7	7	...
Nebraska	28	28	....	24	24	4	4	20	18	24	22	...	...	1	...	20	20	...
Nevada	4	4	....	3	3	1	1	3	3	4	4	...	...	...	...	3	1	...
New Hampshire	37	37	....	29	29	7	7	16	16	23	23	2	2	...	...	19	18	...
New Jersey	250	223	+ 27	161	145	79	64	50	52	129	116	5	5	6	6	84	69	2
New Mexico	2	3	— 1	2	2	....	1	2	2	2	3	...	...	...	...	2	1	...
New York	570	568	+ 2	382	389	157	146	177	178	334	324	30	24	20	13	212	214	8
North Carolina	62	64	— 2	60	60	2	4	42	48	44	52	3	...	2	1	28	39	1
North Dakota	2	2	....	2	2	....	....	2	2	2	2	...	...	...	...	2	2	...
Ohio	656	630	+ 26	434	417	166	161	134	128	300	289	36	29	47	32	192	197	17
Oklahoma	32	26	+ 6	28	24	4	3	18	19	22	22	...	...	1	...	18	17	1
Oregon	45	44	+ 1	39	38	3	5	25	24	28	29	...	1	4	3	19	19	3
Pennsylvania	806	795	+ 11	614	610	138	129	230	241	368	370	32	30	86	76	212	223	16
Rhode Island	44	41	+ 3	28	24	14	15	12	10	26	25	1	1	1	1	19	17	...
South Carolina	22	25	— 3	22	25	....	....	18	22	18	22	...	1	...	1	10	14	...
South Dakota	7	7	....	7	6	....	1	6	5	6	6	...	...	...	...	4	3	...
Tennessee	74	80	— 6	71	75	3	5	40	38	43	43	3	1	3	3	24	33	...
Texas	64	70	— 6	55	59	9	11	35	44	44	55	...	...	4	2	28	39	2
Utah	19	15	+ 4	19	14	....	1	15	12	15	13	1	...	2	1	10	7	1
Vermont	24	25	— 1	23	23	1	2	15	17	16	19	...	...	...	...	33	9	...
Virginia	92	87	+ 5	90	85	2	2	65	57	67	59	2	1	4	3	38	33	3
Washington	89	83	+ 6	74	70	12	12	44	46	56	58	...	2	12	10	37	45	10
West Virginia	51	53	— 2	42	42	6	7	26	26	32	33	1	1	4	4	18	20	...
Wisconsin	290	257	+ 33	205	180	59	45	75	76	134	121	21	18	26	23	92	86	13
Wyoming	2	1	+ 1	1	1	1	....	1	1	2	1	...	...	...	...	1	1	...
Total in U. S.	5,898	5,741	+157	4,325	4,267	1,218	1,160	1,941	1,979	3,159	3,139	249	197	390	304	2,037	2,121	143
Canada																		
Alberta	16	14	+ 2	14	10	2	4	12	9	14	15	1	...	4	2	11	10	3
British Columbia	27	23	+ 4	26	21	1	1	23	19	24	20	...	...	...	1	15	11	...
Manitoba	16	14	+ 2	12	11	3	2	6	5	9	7	...	...	2	1	3	7	2
New Brunswick	21	20	+ 1	18	18	2	2	13	12	15	14	...	...	...	...	11	7	...
New Foundland	1	2	— 1	1	1	....	1	....	....	....	1	...	...	...	...	....	....	...
Nova Scotia	34	35	— 1	30	31	2	2	24	23	26	25	1	...	4	4	9	13	...
Ontario	319	327	— 8	263	269	40	38	116	123	156	161	13	13	13	9	100	107	7
Prince Edward Island	2	2	....	2	2	....	....	2	2	2	2	...	...	...	...	1	1	...
Quebec	102	105	— 3	88	88	12	13	47	45	59	58	4	3	13	10	37	41	5
Saskatchewan	7	6	+ 1	7	6	....	....	7	6	7	6	...	...	...	...	4	4	1
St. Pierre Et Miquelon	1	1	....	1	....	....	....	1	1	1	1	...	...	...	1	....	....	...
Total in Canada	546	549	+ 3	462	457	62	63	251	245	313	308	19	16	36	28	191	201	18
Total in U. S. & Can.	6,444	6,290	+154	4,787	4,724	1,280	1,223	2,192	2,224	3,472	3,447	268	213	426	332	2,228	2,322	161

the United States in 1914 and the figures today indicate a loss of 249 in four years. Canada with 483 in 1914 shows a loss of 21 and the total for the United States and Canada in 1914 was 5057. The total of 4787 today represents a loss of 270 in four years. Among the states, Pennsylvania leads with 614; Ohio is second with 434, a gain of 17 in two years; New York is third with 382, a loss of 5 in two years and Illinois is fourth with 336 a gain of 8 over 1916. Ontario leads in Canada with 263 gray iron shops, a loss of 6 in two years, and Quebec has 88 foundries producing this class of product, showing no change in number over two years ago.

Brass Foundries Increase

A slight gain was recorded by the brass foundry industry, the total number of exclusive nonferrous metal casting plants and brass and aluminum departments of gray iron, steel and malleable iron foundries being 3472 today compared with 3447 two years ago, a gain of 25. The United States has 3159 nonferrous metal melting plants compared with 3139 two years ago, a gain of 20. Canada also shows a gain of 5 with a total of 313 today. Among the states, Pennsylvania ranks first with 368, a loss of 2 over two years ago. The other states rank in the order named and the gain or loss noted is compared with the 1916 total: New York, 334, gain 10; Ohio, 300, gain, 11; Illinois, 224, gain 28; Michigan, 184, loss 6; Massachusetts, 144, loss, 1; Wisconsin, 134, gain 13; New Jersey, 129, gain 13; California, 122, gain, 1; and Connecticut, 101, loss, 3. One of the striking features of these figures is the loss in number of brass foundries recorded by both Massachusetts and Connecticut. These states, for many years, have been the center of the brass casting industry of this country, but the trend is westward as indicated by the gain of 28 brass foundries by Illinois, the gain of 13 by Wisconsin and 11 by Ohio.

The total number of foundries devoted exclusively to the manufacture of nonferrous metal castings shows an increase of 57 in the last two years, the total today being 1280 as against 1223 in 1916. In 1914, this survey showed a total of 1266 and the net gain in four years, therefore, is 14 plants. In the United States, 1218 foundries are engaged exclusively in the manufacture of nonferrous metal castings as compared with 1160 in 1916, a gain of 58. On the other hand, Canada has 62 such plants today, representing a loss of one in the past two years. Ohio leads in exclusive brass foundries with a total of 166, a gain of 5 since 1914. New York is second with 157, a gain of 11 in two years; Pennsylvania is third with 138, a gain of 9; Illinois is fourth with 106, a gain of 11; Michigan is fifth with 94, a gain of 7; Massachusetts is sixth with 87, a loss of 1; New Jersey is seventh with 79, a gain of 15; Connecticut is eighth with 63, a loss of 6 and Wisconsin is ninth with 59, a gain of 14. Massachusetts and Connecticut again show losses in the number of exclusive brass foundries, the former having reported 95 four years ago and the loss in that period is a total of 8 plants. Connecticut reported 72 in 1914 and the decline in the number of its shops in four years is 9. In Canada, Ontario leads with 40, showing a gain of 2 in two years, and Quebec has 12 exclusive brass foundries showing a loss of 1.

Table IV

Leading Foundry Centers of the United States and Canada

	Total foundries 1918	Total foundries 1916
Chicago	188	170
New York	125	115
Cleveland	115	112
Philadelphia	111	106
Detroit	111	103
Milwaukee	94	69
Pittsburgh	76	71
Buffalo	64	68
Cincinnati	63	69
St. Louis	59	63
Boston	54	49
Toronto, Ont.	49	51
Newark	48	45
Baltimore	41	40
San Francisco	40	43
Indianapolis	37	35
Minneapolis	36	35
Dayton	36	33
Erie	33	30
Toledo	33	29
Montreal, Que.	32	29
Seattle	31	23
Rochester	30	30
Louisville	29	33
Jersey City	26	24
Bridgeport, Conn.	26	24
Birmingham	25	29
Reading	23	25
Kansas City	23	22
Worcester, Mass.	23	20
Chattanooga	22	25
Portland, Ore.	22	20
Atlanta	22	17
Providence, R. I.	21	20
Hamilton, Ont.	21	19
Racine, Wis.	19	19
New Haven, Conn.	16	15

Brass and aluminum departments of gray iron steel and malleable casting plants show a further decline indicating the tendency toward specialization in the foundry industry. In 1916, 2224 nonferrous metal departments were operated in connection with iron, steel and malleable foundries as compared with 2192 today, a loss of 32. In the United States, 1941 brass departments were reported, compared with 1979 in 1916, a loss of 38. Canada reported 251 departments of this kind. Pennsylvania leads with 230, against 241 in 1916, a loss of 11; New York is second with 177, a loss of 1 in two years; Ohio is third with 134, a gain of 6; Illinois is fourth with 118, a gain of 17; Michigan, fifth, with 90, a loss of 13, and California, sixth with 81, a loss of 5.

Steel Records Big Gain

The steel casting industry during the past two years probably recorded the greatest growth in its history. Today 426 plants are engaged in the manufacture of steel castings, by the crucible, open-hearth, converter and electric steel processes. In 1916 the total in the United States and Canada was 332 and the gain in number of plants is 94, or 28.3 per cent. The United States shows a gain of 86 with a total of 390 as compared with 304 two years ago. Canada likewise shows a gain of 8 with 36 today against 28 in 1916. Among the states, Ohio shows the biggest gain in the number of steel foundries, with a total of 15, but Pennsylvania and Illinois are tied for second with gains of 10 each. On the other hand, Pennsylvania has almost double the number of steel foundries of any other state in the country and leads with 86, Ohio being second with 47. The other states rank in the order given: Illinois, 38; Wisconsin, 26; New York, 20; Michigan, 19; California, 16; Indiana, 16. In Canada the Province of Ontario leads with 13, a gain of 4 in two years and Quebec is second with 13, a gain of 3 in two years.

Probably the most remarkable showing is made by the electric steel casting industry, 161 plants having reported equipment for the manufacture of steel by the electric process. The United States has 143 of these shops and Canada 18. Illinois and Ohio are tied for first place with 17 each; Pennsylvania is second with 16; Wisconsin third with 13; Washington fourth with 10; California fifth with 9; and Michigan and New York are tied for sixth with 8 each. Attention should be directed to the development of the electric steel casting process on the Pacific coast where the states of Washington and California report more installations than such large foundry states as Michigan and New York.

Almost comparable with the growth

of the steel casting industry has been that of malleable cast iron manufacture, the gain in the number of plants in two years was 55, the United States and Canada today having a total of 268 as compared with 213 in 1916. This is a gain in number of shops of 25.8 per cent. The great majority of these new plants was erected last year when the existing malleable iron capacity was insufficient to meet the pressing needs of industry in general. The United States has 249 malleable foundries, a gain of 52 in two years, and Canada has 19, compared with 16 in 1916. Ohio leads with 36, a gain of 7; Illinois is second with 34, a gain of 5; Pennsylvania third, with 32, a gain of 2; New York is fourth with 30, a gain of 6; Wisconsin is fifth, with 21, a gain of 3; Connecticut is sixth with 17, a gain of 6; Indiana and Michigan are tied for seventh with 16 each, the former showing a gain of 5 and the latter a gain of 7 plants in two years.

Aluminum Casting Industry

With the possible exception of plants casting cooking utensils, there are practically no exclusive aluminum foundries in this country. Many of the brass foundries also engage in aluminum casting work and such departments also are operated by many gray iron shops, principally for the purpose of casting patterns, matchplates, etc. Today, 2037 foundries in the United States and Canada are equipped to make aluminum castings as compared with 2121 in 1916, a loss of 84. Canada has 191 compared with 201 two years ago, a loss of 10. The total for the United States and Canada is 2228 compared with 2322 in 1916, a loss of 94. New York and Pennsylvania lead with 212 each, representing losses of 2 and 11 aluminum foundries and departments, respectively. Ohio is second with 1912, and the other states rank in the order given: Illinois, 155; Michigan, 129; Massachusetts, 104; California, 94; Wisconsin, 92 and New Jersey, 84. The greatest gain in the number of aluminum foundries was recorded by New Jersey with a total of 15 and Pennsylvania shows the greatest loss with 11.

Chicago retains its supremacy as the leading foundry center of the world with a total of 188 shops compared with 170 two years ago, a gain of 18. New York is second with 125, a gain of 10 in two years, and Cleveland is third with 115, a gain of 3. Philadelphia and Detroit are tied for fourth place and Milwaukee with 94 casting plants, a gain of 25 in two years, replaces Pittsburgh for sixth place. Pittsburgh reports 76 foundries, a gain of 5, whereas Buffalo, which ranks next, has 64 casting shops, a loss of 4 in two years. Cincinnati is ninth with 63, St. Louis tenth with 59, Boston is eleventh with 54, a gain of 5 in two years, and Toronto is twelfth with 49, a loss of 2 since 1916. The order of the other leading foundry centers of the United States and Canada, together with a comparison of the number of casting shops which they have today and 1916 is given in Table IV.

Mounting Patterns on Plates an Aid to Molding

(Concluded from Page 454)

patterns which should have consideration. It involves casting the plate and pattern integrally in the mold. The mold is made in a strictly true flask large enough to take in the full lateral mold dimensions of the plate the flask being separated by the thickness of the plate desired. Iron strips usually are used to separate the mold and are cut to the plate form and dimensions. They are set in the sand of the mold, necessary precautions being taken to provide against a run-out in pouring the metal which usually is aluminum or an alloy with an aluminum base. Better than the disjointed iron strips for this purpose, we have found the frame cast of brass, since it retains shape and gives indefinite service and a more uniform thickness of plate. It is apparent that by this method a mounted plate may be made from a mold of almost any parting and from most any kind or shape of pattern. Its disadvantages are chiefly the abnormal shrinkage occasioned by the bulk of metal and the difficulty of finishing the pattern. If lathe work co-ordinates the finishing operation the whole plate has to be swung in order to get at the pattern. To obviate these difficulties we prefer casting only the pattern or the pattern and that part of its field involved in an irregular parting surface. This is then set in a plate independently cast or machined for the purpose. This plan is satisfactory as it does not interfere with the matching since it makes no difference what relative position the pattern observes to the flask pin or guide, so long as halves are coincidingly opposite each other and the casting will match exactly the same as in the split pattern, hand-molded. The idea often will bear expansion to substantial advantage. One instance of its application covered small wing nuts ordered periodically by the thousand. Solid patterns were furnished obviating the split pattern method of mounting. We had and could get nothing but the poorest grade of zinc-contaminated aluminum scrap and were unable to get a satisfactory plate. Finally, four narrow strips were molded by the method outlined, each strip containing 10 patterns. These strips were poured of a good white metal pattern mixture and after finishing, were set in a plate.

Aluminum Pistons in German Airplane Engines

By C. Vickers

The composition of the aluminum pistons with which a 230-horsepower Benz airplane engine, recently captured by the British, was found to be equipped, were as follows, according to a report made by the technical department of aircraft production: Aluminum, 80.12 per cent; zinc, 12.13 per cent; copper, 6.02 per cent; iron, 1.42 per cent; silicon, 0.31 per cent; manganese, trace; magnesium, trace; nickel, none and tin, none. Criticising the alloy it appears that the copper is rather high in view of the aluminum content and when this and the large amount of iron are taken into consideration it is evident the alloy greatly resembles cast iron in its properties. Cast iron, in the past, always has been used for the pistons of Benz engines, and the formula for the aluminum alloy probably was densed to parallel the properties of cast iron as closely as possible. The use of the aluminum pistons effected a saving of weight of 2 pounds, 13 ounces per piston, although they were reinforced with webs cast on the inside of the domed heads. The traces of manganese and magnesium are unimportant as it requires considerably more than a trace of either of these metals to influence the properties of aluminum. Their presence indicates that a small percentage of selected scrap had been utilized in making the castings. The silicon is a normal impurity of aluminum and exists in this alloy in normal amounts, and with silicon as low as shown, the iron also should have been normal in amount; the fact that it was not, would indicate that about 1 per cent of iron had been deliberately added to the alloy. Its value is questionable, unless it was used with the idea of saving 1 per cent of copper, which is probably the case. A chill-cast alloy consisting of aluminum, 80 per cent; zinc, 15 per cent and copper, 5 per cent, would prove superior to the German alloy.

The Hooper-Falkenau Engineering Co., Woolworth building, New York, industrial engineer and architect, has suspended its business for the duration of the war. Its principals, G. K. Hopper and A. Falkenau, have entered government service, both having accepted commissions as majors.

Effecting War Economies in the Plating Room

The Author Points Out How Waste May be Eliminated and Metals, Acids and Other Materials Conserved by Exercising Greater Care in Operation

By E P Later

METAL finishing, at no time is an art devoid of troubles and vexations. There usually are plenty of problems to be solved and difficulties to be straightened out, but at present platers can rightly be regarded as laboring under really adverse conditions. Not only are supplies of all kinds costly and scarce, but workmen are not plentiful and with an ever-increasing number of men going into military service or other lines of industry, it seems that no material improvement of this condition will take place very soon. We are confronted with the problem of turning out the required amount of work with insufficient help and besides, it may be inexperienced help, with the utmost economy of materials; the latter are hard to get in some instances and all of them are much more expensive than formerly; consequently, unless care is exercised, the cost of finishing will reach dizzy heights.

Expedients Resorted to

Whether adversity is always good for body and soul may be left to the bearded philosophers for discussion, but there can be no doubt that under the stimulus of rigid necessity it is generally possible not only to eliminate a surprising amount of waste, but to work out new and better ways of accomplishing desired ends. With this thought in view it has seemed worth while to consider some of the economies and schemes which are finding application in various establishments in the effort to offset present conditions, and to forestall future shortage.

In the matter of lessening consumption of supplies the first step is to eliminate all waste, to make sure that only so much of the material, whatever it may be, is being used as is actually required. Take acids for example; nitric and sulphuric are nearly indispensable around the plating room, while they are of the utmost importance in the manufacture of explosives. Therefore, it behooves the plater to use them as sparingly as possible. In a previous article in which the pickling and cleaning of parts preliminary to finishing was discussed, it was pointed out that the use of acid for these purposes may be materially reduced by other methods of accomplishing the same results, such as sand-blasting and tumbling. In cases where acids must be employed, care should be taken to see that spent acid is not thrown out until all of its strength has been utilized.

I know of at least one instance where a firm which operated a large finishing department, including a galvanizing plant, reduced its consumption of acids nearly one-half, through more careful supervision. In the galvanizing department in particular, the man in charge of the large pickling tanks had always been allowed to draw off the old pickle and make up a new one whenever he felt like it. It was his custom to dump out all solutions after a certain length of time, regardless of how little or how much work had been pickled. When acids began to get scarcer and more costly the plan of determining the strength of the acid in each tank before dumping it was inaugurated. This showed that a startling quantity of acid was being thrown into the sewer every day. Orders were then given that no pickle should be discarded until the iron and acid contents had reached certain limits; fresh acid could be added as needed to maintain effective action, but the solution must be used until the free acid present had fallen to the lowest practicable limit.

Reducing Acid Waste

The reason for putting limits on both acid and iron content is that it is not practicable to use up quite *all* of the acid in the pickle; when the concentration becomes very low the action is so slow that too much time is required. However, it takes a very appreciable amount of acid to make several hundred gallons of solution containing the lowest workable percentage of acid, consequently, if the whole thing were dumped out as soon as the free acid had dropped to this point this amount of acid would be utterly wasted. If, on the other hand, we avoid making up new pickle until the old one becomes clogged with iron, so to speak, and as much as possible of the acid is used up, we decrease waste of the latter very materially.

In the effort to use up bright dips and pickles as completely as possible, it is the practice of several platers of my acquaintance to set them aside when they become too slow in their action for ordinary use and to employ them to clean or pickle parts which, by reason of their character or the way the work is running in the plating room, can be allowed to remain in the acid a longer time than usual. Diluting somewhat with water and heating to near the boiling point while in use, will hasten the action. For rough work or as a preliminary operation, to be followed if desired by a final brightening or dip in fresh acid, such a plan seems to succeed very well; with the exercise of a little care there is slight danger of spoiling anything, while it is possible to use a dip in this way until the free acid is reduced to a very low percentage.

Testing for Acid Strength

The amount of acid present in a pickle or other acid solution can be ascertained easily, and thus it may be determined whether it is worth keeping. The only materials required are a burette, an alkali solution of known strength, a small flask or beaker and what is chemically known as an indicator. Without going into all of the details of the manipulation, which may be obtained from any one of a number of textbooks or from a chemist or druggist friend, the process consists in measuring out say five cubic centimeters of the supposedly spent pickle; if the strength of a new pickle or dip were being determined the amount of acid would be so large that only a fraction of a cubic centimeter should be taken, otherwise a very large amount of the standard alkali solution would be required; the acid is measured out by means of the burette or a small pipette, running it into the flask or beaker and diluting with 20 or 25 cubic centimeters of distilled water. Two or three drops of methyl orange indicator should now be added and the standard alkali solution slowly run in from the burette, stirring carefully meanwhile, until the color of the liquid changes.

The alkali used may be either sodium

carbonate, bicarbonate or hydroxide and a convenient strength of solution for the foregoing purpose is what is known as tenth-normal. A pickle or acid dip may be composed of sulphuric acid alone or a mixture of nitric and sulphuric acids, but since, in the latter case, a rather long chemical analysis would be required to determine how much of each acid was present, it will usually suffice to make our calculations and express the results on the basis of sulphuric acid alone. After the titration has been made as outlined, multiplying the value of one cubic centimeter of the alkali in grams of acid by 20 times the number of cubic centimeters required to neutralize five cubic centimeters of the solution under test will express the acid content of the latter in per cent, or, if it is desired to express the results as ounces of acid per gallon, the value of one cubic centimeter of the alkali in grams of acid should be multiplied by 200 times the number of cubic centimeters of alkali required to neutralize five cubic centimeters of the solution under test and this result is divided by 7.5.

Determining Alkalinity

The consumption of alkaline cleaning compounds can usually be reduced by the exercise of care to see that solutions of this sort which still contain enough alkali to be usable, although they may be slower in their action, are not thrown out. The determination of the alkalinity of a solution is just as easy as the determination of acidity and is carried out in substantially the same manner, only in place of titrating the solution under test with standard alkali, we use an acid solution of known strength; tenth-normal sulphuric acid will answer the purpose very nicely.

In order to determine the *total* alkalinity of a cleaning solution, say, it is only necessary to measure out five or 10 cubic centimeters, depending on the strength, into a beaker, dilute to 25 cubic centimeters with distilled water, add two or three drops of methyl orange and titrate with the standard acid until the formation of a permanent pink or red color.

The alkalinity thus determined may be due to hydroxides, carbonates or bicarbonates or any combination of these, therefore, it is hardly logical to express the results as a percentage of any one of them. It is probably better to report the alkali as sodium oxide. One cubic centimeter of tenth-normal sulphuric acid is equivalent to 0.0031 gram of this, consequently, it is only necessary to multiply the number of cubic centimeters of acid required by 0.0031 and then by 10 or 20, depending on whether ten or five cubic centimeters of solution were taken for test. The result is per cent of alkali as sodium oxide.

Preventing Waste of Anodes

Waste of anodes is to be prevented by seeing that they are used up as completely as possible in the solution; and right here it may be remarked that it is the poorest sort of economy to try and save on anodes, either by using too small a number of them or by maintaining conditions such that the corrosion of the anodes is retarded. Plating solutions should be made and kept as nearly self-sustaining as possible, otherwise frequent additions of metal salts will be necessary; the metal which is deposited on the parts must come from somewhere and it is considerably cheaper to obtain it from the anodes than from salts. And yet I have known one or two platers who were openly boastful of their success in getting anodes to last a longer time than they normally should have done. Such a state of affairs leads either to impoverished solutions, with the attendant consequences of defective work and low efficiency, or large amounts of salts must be used to make good the deficiency in metal.

One often sees anodes suspended in a plating bath in such manner as to leave a few inches of the upper end projecting out of the solution, in which case this portion is not attacked or dissolved; as a consequence, a sizable piece of metal is left after the body of the anode has disappeared more or less completely. Formerly, it was often the practice to sell broken anodes and stub ends as scrap metal, which brought a considerably lower price than that paid for good metal in the form of anodes, but a more economical utilization is now a matter of necessity. This is usually sought either by welding, with the oxyacetylene torch, a number of stub ends together so as to form a new anode, or by the use of some form of clamp or holder in which the short ends can be placed and the whole device then submerged in the solution. In the case of nickel stubs some platers simply bore a small hole through these and string them on an iron wire; the latter is, of course, slowly dissolved, but the amount of iron which thereby gets into the bath is too small to do any serious harm, if only a few of these improvised anodes are used in one tank.

Preventing Scrap Ends

It is not a difficult matter, however, to reduce the production of anode scrap to a minimum. In the first place, if the plating tanks are kept filled to the level of the upper end of the anodes, this can easily be done by the daily addition of sufficient water to make up for evaporation and the amount of solution that is lost by being removed on the work, there will not be much left in the way of stub ends.

Trouble is often experienced through the breaking of anodes about half-way down; they appear to corrode more through the middle portion, and eventually the metal there becomes so thin that it is not strong enough to support the heavy lower end, and breaks, with the result that about half of the anode lands on the bottom of the tank.

The cause of this condition is to be found in the way in which the parts are hung in the tank; if they are all suspended at about the same level it is easily seen that corrosion of that part of the anodes opposite them will be more severe than anywhere else, and after a time, breakage will occur. The remedy is, of course, to stagger the parts, as it were; put plenty of them in deep enough so that the lower end of the anodes will have a chance to become active and thus go into solution.

Preventing Waste of Precious Metals

With the precious metals, gold and silver, the necessity of preventing all waste is of considerably more importance than in the case of less expensive materials, but all, or practically all, establishments plating these have worked out more or less satisfactory and efficient methods of utilizing or disposing of scrap anodes, acid solutions used for stripping, and so on, and probably little good would be done by detailing some of those methods. It may not be out of place, however, to mention that in several instances that have come to my notice too little attention was paid to the rinse water. A good deal of precious metal gets into this in the course of time, but in the cases mentioned no effort was made to recover it. This is not a difficult matter and may be done either by evaporating the rinse water down to a comparatively small bulk and then precipitating the metal out in any desired way or this liquor may be added to the bath, in place of water, to make up for evaporation, and so on. This latter procedure has the advantage that a good deal of the cyanide present is also saved.

Of course, the amount of nickel or copper, for example, which is lost through the rinse water hardly amounts to enough to warrant any attempts to recover it, but leaky tanks can be the source of an appreciable loss in the course of a year or so, and it will usually pay to give this feature some attention. Some thrifty

INFORMATION FOR THE BRASS FOUNDRYMAN

SCRAP METAL SPECIFICATIONS

The specifications adopted by the National Association of Waste Material Dealers for scrap nonferrous metals are as follows:

Heavy Copper

Heavy copper shall consist of copper not less than ⅛-inch thick, and may include trolley wire, heavy field wire, heavy armature wire that is not tangled; also new copper clippings and punchings, untinned and clean, and also copper segments that are clean.

No. 1 Copper Wire

No. 1 copper wire shall consist of clean, untinned copper wire not smaller than No. 16 B. and S. wire gage, to be free from burnt copper that is brittle, and all foreign substances.

No. 2 Copper Wire

No. 2 copper wire shall consist of miscellaneous clean copper wire such as of necessity would be sorted out of Heavy Copper wire and No. 1 Copper Wire, but to be free of hair wire and burnt wire which is brittle.

Light Copper

Light copper scrap shall consist of the bottoms of kettles and boilers, bath tub linings, hair wire, burnt copper wire which is brittle roofing copper and similiar copper; it should be free from visible iron, brass, lead and solder connections, old electrotype shells and should not contain excessive paint, tar and scale.

Cocks and Faucets

Cocks and faucets shall be mixed red and yellow brass scrap, free from gas cocks and beer faucets; this scrap should be at least half red brass.

Heavy Yellow Brass

Heavy yellow brass scrap shall consist of heavy brass castings, rolled brass, rod brass ends, brass screws and tinned or nickel-plated brass tubing; it should be free from iron and dirt and must be in pieces not too large for crucibles; no piece should measure more than 12 inches over any one part; also it must be free from aluminum and manganese mixtures. Condenser tubes shall not be considered as heavy brass.

INFORMATION FOR THE BRASS FOUNDRYMAN

SCRAP METAL SPECIFICATIONS

Light Brass

Light brass scrap shall consist of light sheet brass, forks, spoons and miscellaneous brass that is too light for heavy work. It must be free from visible iron, gun shells containing paper, iron-loaded lamp bases and the works of clocks.

New Brass Clippings

New brass clippings shall consist of the cuttings of new sheet brass and must be absolutely clean and free from any foreign substance.

Brass Tubing

Brass scrap tubing shall consist of brass tubing free from nickelplating, tinning or soldering, or tubes with cast brass connections. Sound, clean tubes, free of sediment, and condenser tubes only should be accepted.

No. 1 Composition Turnings

No. 1 composition turnings shall be free from aluminum, manganese, plastic and yellow brass turnings and must not contain over 2 per cent iron. They should be free from grindings and other foreign material, especially babbitt and adulterations made to resemble metal. Turnings not according to this specification should be subject to sample.

No. 1 Yellow Brass Turnings

No. 1 yellow brass turnings shall consist of strictly rod turnings, free from aluminum, manganese, composition and tobin turnings. They should not contain over 3 per cent iron, oil, or other moisture and must be free from grindings and babbitts. To avoid dispute, they should be purchased subject to sample.

Composition or Red Brass

Composition or red brass scrap shall consist of red brass, valves, machinery bearings and other parts of machinery, including miscellaneous castings made of copper, tin, zinc, and (or) lead, no piece to measure more than 12 inches over any one part; it should be free from aluminum, manganese, railroad boxes, cocks and faucets, gates, pot pieces, ingots and burned brass.

Railroad Bearings

Railroad bearings shall consist of railroad boxes or car journal bearings classed as used standard scrap and free from yellow boxes and babbitt; excessive grease and dirt on this scrap should be cause for rejection.

THE FOUNDRY DATA SHEET, OCTOBER, 1918

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

Note—This sheet may be cut into two sections, 5 x 7 inches, and may be readily bound in note book form.

platers make a practice of scraping off the metal salts from the sides of the tanks and wherever they may be found, dissolving in water and then filtering and returning the clear liquor to the bath; there is no doubt that a good deal of perfectly good salt can be and is saved in this way. Care must be taken, of course, to avoid contamination with other metals.

Metal Lost on Racks

Another source of loss of metal, and one which has attracted some little attention, is that occasioned by the deposits which form on the racks and wires employed to support the work. Unless means are taken to prevent it, heavy deposits are formed in a comparatively short time and in the aggregate this will amount to a good many pounds of metal, which is rather too expensive to throw away. Therefore, it usually is removed by pounding or breaking it loose or dissolving in acid. The latter procedure has the disadvantage that the racks or wires themselves are attacked by the acid and some of the metal of which they are composed is taken into the solution, thereby contaminating it to that extent. Numerous attempts have been made, and with some measure of success, to design a rack insulated in such manner that the amount of metal deposited on it would be reduced to a minimum. Perhaps the best all-around scheme, however, is that of covering the body of the rack, everything except the hooks, with an insulating compound which will resist acids and alkalis, both hot and cold. As the coating material wears thin, or is removed in one way or another, it can easily be renewed.

Several times I have been asked how a bath which has become contaminated with some other metal can be restored. Baths are occasionally put out of commission through the accidental introduction of some foreign substance and the plater is then faced with the necessity of either removing the offending materials or dumping the whole bath, which may cause the loss of a good many dollars. While this is not strictly a war-time problem, it is particularly vexing now in that the loss of any material is more costly than usual.

The procedure in a case of this kind depends on what kind of a bath it is and what it is contaminated with. Any metal can be separated from any other metal by chemical means, and sometimes by electrolysis, but in many cases the manipulation and time required, to say nothing of the chemicals needed, would make it utterly impracticable to atempt anything of the sort, on the scale that would be necessary in treating a good-sized plating bath. Copper in a nickel solution seems to be most frequently mentioned, perhaps because it is the practice in many places to give iron parts a coating of cyanide copper before nickeling. For the sake of any who may encounter this difficulty it may be said that the easiest and simplest way of getting rid of copper is to make the solution slightly acid, rather more so than usual, and suspend thin sheet steel plates in it. Under these conditions the copper will plate-out in the metallic state on the iron, from which it can be removed later and the process repeated as often as necessary. Of course, a corresponding amount of iron will go into the nickel solution, but small amounts of it will not do any particular harm, at least not so much as the copper. The deposit from a nickel bath containing an abnormal amount of iron is inferior in that it tarnishes and corrodes more readily.

In other cases it is sometimes possible to save a bath which has become so contaminated as to be unfit for use, by taking a portion of it and making up to the original volume with new solution, thereby reducing the amount of foreign substances enough to make it harmless.

Conservation of Buffs

Right now the cost of buffs is anything but a negligible item, consequently anything that can be done to lessen it is well worth the effort. In a previous article it was pointed out that much can be done to reduce the cost of both buffs and buffing if some attention is paid to the selection of well-made wheels which are suited to the class of work on which they are used and operated at the proper rate of speed. Buffs, like everything else, will wear out in time, but we can at least see to it that the maximum amount of work is obtained from them before they do wear out.

After a wheel, however, has been so reduced in diameter that it is no longer usable as it stands, we can still make it serve us by the use of a small device which has been on the market for some time. Briefly, it consists of a metal hub or holder which serves to clamp firmly together a number of stubs or worn-down wheels. Wheels 14 inches or so in diameter can be built up in this way and when they are finally worn down to the usable limit there is so little left of the original stubs that the plater can throw them away without any qualms.

The question of help is a perplexing one just now and many platers are having their full share of trouble in keeping things running smoothly. Years of experience and study are required to make a really good plater; so the task of breaking in new men to anything like reliability and efficiency is usually not an easy one. In this connection the tactics used by a certain foreman plater of unusual ability and many years experience, who has trained a large number of very skillful workmen, are worthy of note.

Training New Men

When a new man is assigned any task connected with any of the finishing processes this foreman explains very carefully what he wants done, how to do it and why. In an easy and quiet way he almost always manages to impart some of his own very real enthusiasm to the other fellow and as the later shows more interest and a greater desire to learn, he helps him in every way to gratify this wish. It requires a little extra time and effort, of course, but it pays well, for in a few weeks or months he usually has a workman who may not know all there is to know about plating, but who does have a reasonably thorough grasp of the particular job he is doing; he knows what to do, what not to do, and why. Nine times out of ten his method produces a *reliable, intelligent* and *interested* workman in a very short time.

When new workers can not be secured the only thing to do is to make an extra effort to increase the working efficiency of the plant to the highest degree. Rearrangement of a poorly laid-out plating room will almost always result in the elimination of a large amount of waste motion and effort, with a consequent increase in output. So, too, will the use of solutions which permit the employment of higher current densities, for example rapid nickel baths, speed-up production markedly.

When labor is scarce more dependence must be placed on labor-saving devices and machinery and many establishments are making a wider use of such equipment. This is not the place to exploit the products of any manufacturer, but it may be noted that there are on the market machines for automatically buffing parts which are not too large or too irregular in shape; other machines will pickle, rinse and dry a large variety of metal parts; other devices automatically clean, rinse and plate any parts which can be handled in bulk in this manner. All of this is done with the minimum amount of manual handling. Even the lowly tumbling barrel, when properly designed for the different kinds of work, can clean the parts, put a high finish on them, eliminating buffing.

FIG. 1—THE LANGSENKAMP & WHEELER BRASS FOUNDRY IS LAID OUT WITH THE IDEA OF GIVING EACH MAN PLENTY OF SPACE TO HANDLE HIS WORK — THE BUILDING IS REINFORCED CONCRETE CONSTRUCTION WITH AN ARCHED ROOF

How Brass Carburetors Are Molded and Cast

Molding Machines of the Jar-Ram Squeeze Type Are Extensively Employed—Workmen Held Responsible for Quality of Product

THE tremendous influence exerted by the automobile industry on the development of American foundry practice in the past 10 years is a matter of common knowledge to all students of industrial affairs. The requirements of the automobile manufacturers have been felt throughout all of the ramifications of the castings business. In brass foundries as well as in gray iron, steel and malleable shops this influence has been potent. In fact the demands of the motor-car industry probably have brought about more striking advances among the nonferrous shops than in other branches of the foundry business. As a result, the haphazard methods of a decade or so ago have given place to modern industrial procedure in most of the brass foundries in the United States. Great strides have been made in brass foundry metallurgy, as well as in methods of melting, handling materials and general shop practice. In the molding room the changes wrought by the past few years have been almost revolutionary. In practically all modern brass shops of the advanced type hand molding has given place to machine methods. Progressive brass foundrymen are keenly alive to the possibilities of machine molding and have been quick to take advantage of the possibilities of the latest developments. For molding small intricate brass castings on a quantity basis machines of the combination jar-ram and squeeze type seem to possess peculiar advantages since they eliminate practically all hand tucking and make it possible to turn out uniform work.

Special progress has been made in the development of machine molding methods for the manufacture of carburetor bodies and other brass carburetor parts for automobiles, marine engines, motorcycles, tractors, etc. Since our entry into the war the demand for carburetors of unusually large size for heavy-duty marine engines has been unusually large. Heavy parts for these carburetors are now made exclusively on molding machines.

Among the leading producers in this field the Langsenkamp & Wheeler Brass Works, Indianapolis, has been prominent for a number of years. This firm operates a large brass foundry devoted almost exclusively to the production of various types of Schebler carburetor castings for the carburetors made by the Wheeler-Schebler Carburetor Co., Indianapolis. Schebler carburetors are especially prominent in the marine field and as a result of the activities of the Wheeler-Schebler company in this direction, the Langsenkamp & Wheeler Brass Works has been called upon to solve a number of manufacturing problems of unusual difficulty.

At the present time about eight tons of brass are poured daily in the shop of Langsenkamp & Wheeler. The output includes very large castings for heavy marine carburetors, intricate castings for automobile, motor-truck and tractor carburetors and small, light castings for motorcycle carburetors. In addition, a small amount of jobbing work is handled and occasionally brass castings weighing several hundred pounds are made. Most of the work, however, is of the light, repetition type. Practically all of it is unusually intricate. Many of the carburetor bodies are completely water-jacketed. Special arrangements must be made in many cases for removing the core sand from the jackets. Holes, which are afterwards closed by screwed or sweated plugs, are left in the castings for this purpose. The interior construction of the carburetor bodies also is such that great ingenuity is required to make the cores and this feature of the work receives special attention at the Langsenkamp & Wheeler plant. Practically all of the carburetor parts are molded on machines of the combination jar-ram, power-squeeze type built by the U. S. Molding Machine Co., Cleveland. The machines, which are specially rigged for the work, are arranged in rows

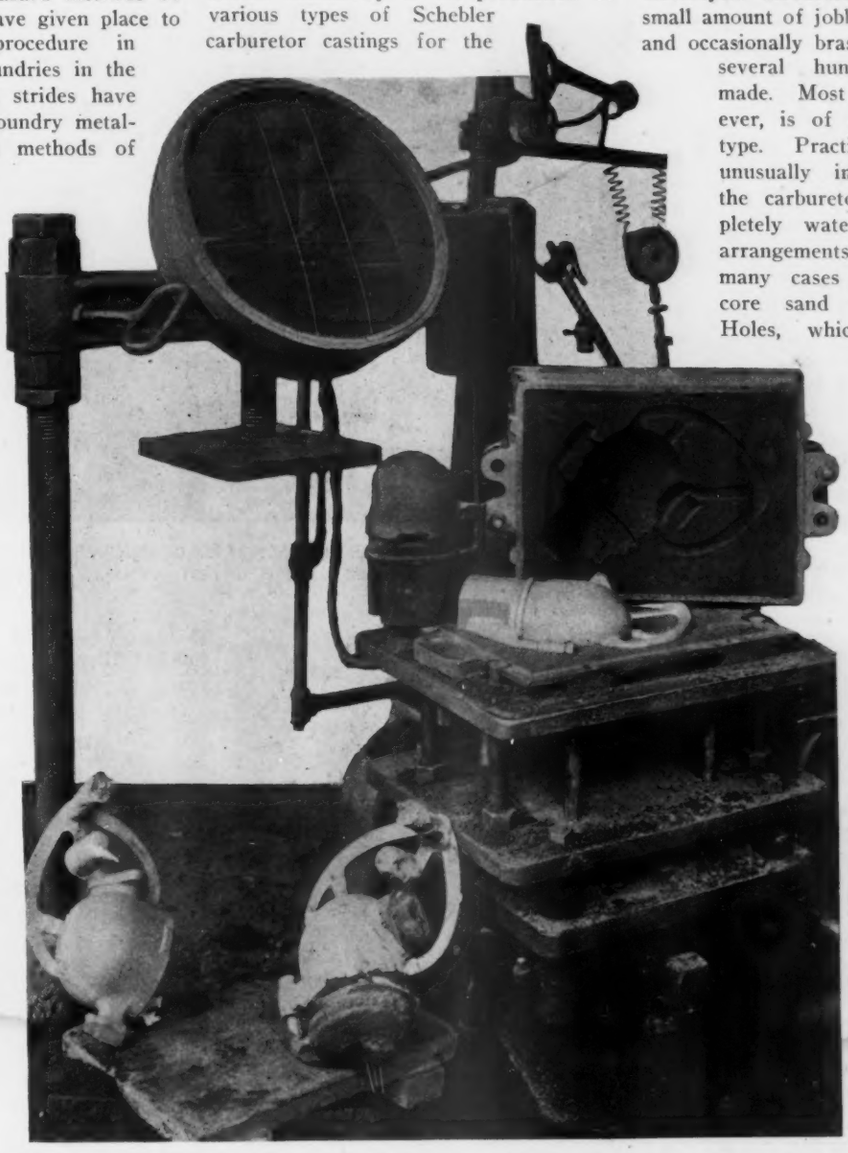


FIG. 2—COMBINATION JAR-RAM AND SQUEEZER MACHINE EQUIPPED TO MOLD LARGE MARINE-TYPE CARBURETORS—THE PATTERN PLATE IS HEATED BY AN ELECTRICAL COIL

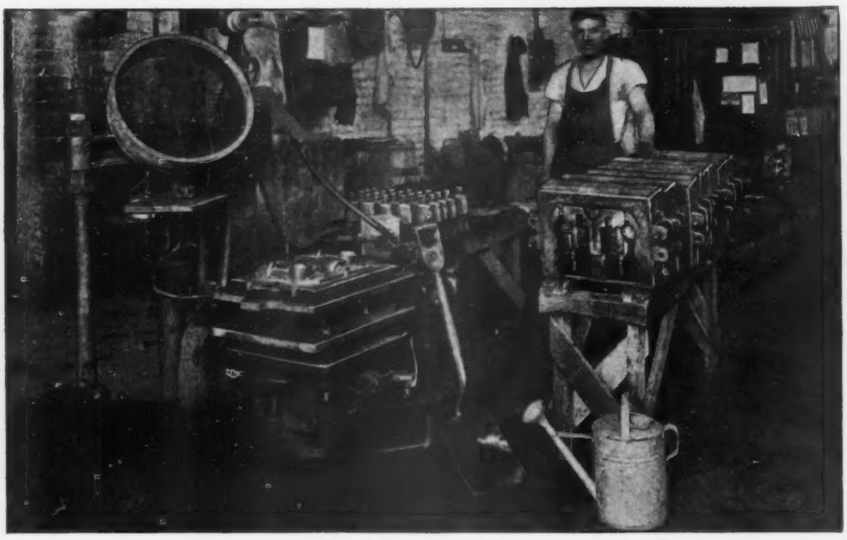


FIG. 3—MACHINE FOR MOLDING TRACTOR CARBURETORS—THE FINISHED MOLDS ARE SET ON EDGE ON A BENCH NEAR THE MACHINE BEFORE BEING FINALLY PLACED ON THE FLOOR

running across the shop with ample floor space between for laying out the molds. The general arrangement is shown clearly in Fig. 1. These machines perform all of the molding operations without hand trucking of any kind. Some of the patterns have deep projections which add to the difficulties of molding. The patterns, however, are designed with sufficient draft to accommodate these conditions and special attention also is given to the sand, so that relatively little difficulty is experienced and the losses are low, averaging in some cases less than two per cent.

It is the policy of William Langsenkamp, vice president of the company, in charge of operations, to hire inexperienced men and train them on the premises, specially for the kind of work handled by Langsenkamp & Wheeler. This system has proved more satisfactory than the employment of so-called skilled molders and in addition labor costs have been materially reduced. At the same time the piece rates are so adjusted that men with satisfactory qualifications earn good wages.

Mr. Langsenkamp believes in giving his men an all around training. In addition he is a strong advocate of the concentration of responsibility and for this reason the work is so arranged that each molder is individually responsible for the quality of the castings produced on his floor. To this end the men are required to pour their own work, shakeout the flasks, cut over the sand, set the cores and close the molds. In addition each man makes the cópes and drags for his own floor, changing the pattern plates on the machine if necessary. The metal is brought to the floor by helpers.

The men arrange their work by tasks. Each man first molds up ten or a dozen drags, placing them on edge on a bench provided for that purpose, as shown in Fig. 3. After a group of drags are finished they are set out on the floor ready to receive the cores and copes. Sometimes the cores are set on the bench before the drags are shifted to the floor. After the cores are set the pattern plates are shifted if necessary and a group of copes are molded. The molds are then closed and when the metal arrives, they are poured. Afterward, of course, the poured molds are shaken out and the sand is cut over. These tasks do not necessarily follow in the order just described. In fact, the division of the work into tasks is designed to make it certain that each man will always have something to do. Since there is plenty of space on the floor, it is always possible to mold up a few more copes and drags while waiting for metal, or to cut over sand while waiting for cores, or to set cores while awaiting an opportunity to shake out flasks. Each

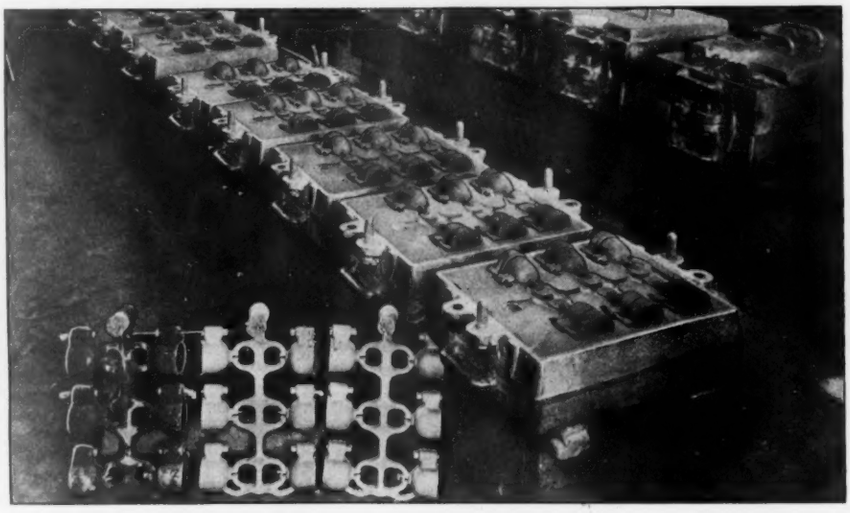


FIG. 5—A FLOOR OF MOTORCYCLE CARBURETORS SIX OF WHICH ARE CAST IN A 12 x 16-INCH FLASK SHOWING THE CASTINGS AS THEY COME FROM THE MOLD

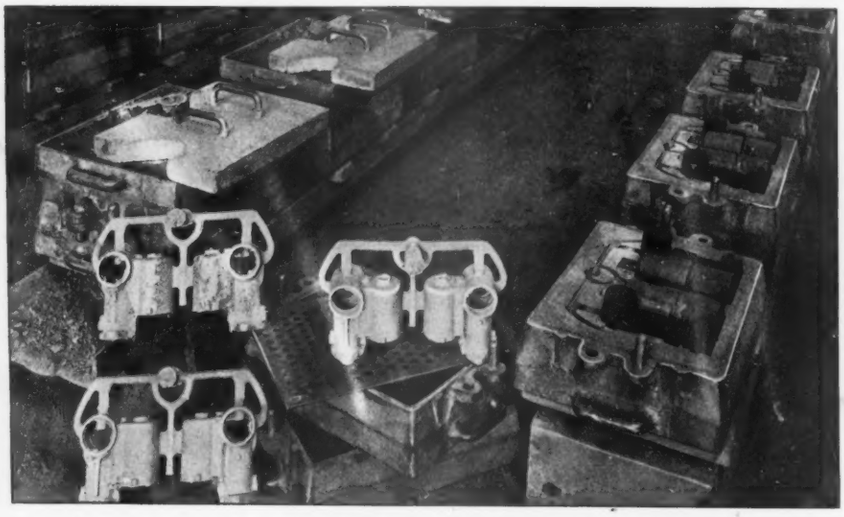


FIG. 4—A FLOOR OF TRACTOR CARBURETORS—SOME OF THE MOLDS HAVE BEEN POURED, OTHERS ARE WAITING TO RECEIVE THE COPES

man always has some definite task ahead of him all the time.

As a result, the work progresses smoothly and steadily throughout the day. Molten metal is available from early in the morning until late in the afternoon and pouring proceeds practically continuously. Mr. Langsenkamp realizes that this system, which requires the machine men to perform all of their auxiliary tasks themselves results in a sacrifice of some of the advantages in speed and skill which accrue from minute subdivision of effort. He believes, however, that these disadvantages, if they exist, are fully counterbalanced by the improved quality of work resulting from fixing the responsibility firmly on the individual molding machine operators. He also believes that his system produces a flexible organization, and that in the long run molds are produced at as low a cost as they might be if the labor effort were more completely subdivided.

On account of the nature of the castings turned out, special attention must be given to the molding sand. As previously described, each man cuts over his own sand heap. The work is so arranged that the hot sand recovered from molds shaken out in the forenoon is placed at the back of the floor where it has time to cool off and season until the next day. A given quantity of sand is rarely used twice on the same day.

A fair proportion of the castings are symmetrical. In such cases of course the copes and drags can be molded from the same pattern plate. Where necessary, however, two plates are provided for each machine and the rigging is so arranged that the plates may be changed in a minimum of time. The sand is hand riddled onto the patterns using a riddle of the type shown in Figs. 2 and 3. The sand is shoveled from the floor into the flasks by hand.

At the present time the Langsenkamp & Wheeler Co. is making a large number of castings for marine carburetors. The method of molding one of the largest of these is illustrated in Fig. 2. This carburetor is provided with 2-inch pipe connections. The pattern, which is of white metal composition, is split through the middle and mounted on plates suitably arranged for fastening to the table of the molding machine. The rough casting weighs 10 pounds. It is gated at two points on the bottom and two on the side. The core is received by the molder completely assembled and ready for insertion in the mold. Fig. 2 shows the drag half of the mold, with the pattern-plate in place on the machine. The core may be seen standing at one side of the pattern plate. Castings before and after the core has been removed, are shown in the lower left foreground.

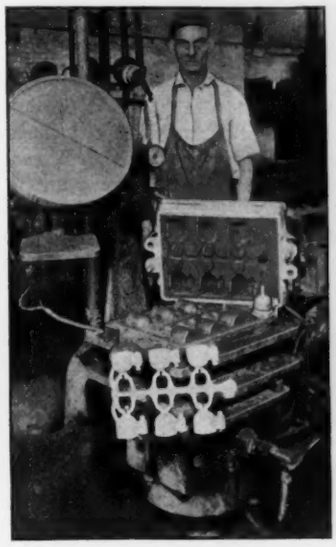
Each mold is given about six bumps followed by a squeeze. The machine is equipped with an air gage and the molds are all rammed to a uniform pressure. The uncertainties of hand molding, therefore, are eliminated.

Patterns Electrically Heated.

When molding machines were first tried out some difficulty was experienced from sand sticking to the pattern. An effort was made to overcome this by warming the pattern-plate with a gas flame. This expedient was only partially successful since the jar-ramming operations frequently extinguished the gas jet. Constant attention and relighting, therefore, was necessary. Complete success was finally obtained by employing electric heaters. Each molding machine is equipped with a heater of the standard resistance type. The heating coil is wired through a switch conveniently located above the machine as shown in Fig. 2. The switch is arranged to provide three degrees of heat, low, medium and high, and this makes it possible for the workman to control the temperature of the pattern-plate with very little effort. The plates are heated until they are just perceptibly warm to the bare hand. It is not necessary to control the temperature accurately and the men soon learn by experience the proper degrees of heat for the various classes of work. This method of heating pattern-plates eliminates practically all trouble from sticking sand and also makes it possible to virtually do away with talc or other special facing material. Ordinary fine brass-foundry sand mined at Newport, Ky., is utilized.

For castings of the class shown in Fig. 2, and in fact for practically all of the carburetor work turned out in the shop, 12x16-inch cast iron flasks are used. These flasks have machined joints and the copes and drags are each fitted with both male and female pin connections as may be noted on the flask shown in Fig. 6.

Fig. 3 shows a U. S. combination jar-squeezer machine arranged for molding 1½-inch tractor carburetors. Two castings are made in each mold, 12x16-inch flasks being employed. As fast as the molds are made they are set up on edge on the bench shown at the right. From this point they are transferred to the floor where they are set on special benches for pouring as indicated in Fig. 4. These floor or pouring benches are of two types, concrete and steel. The steel bench, shown at the left in Fig. 4, consists simply of a 12-inch channel set on suitable cast iron supports with the flanges turned upward. The flasks are



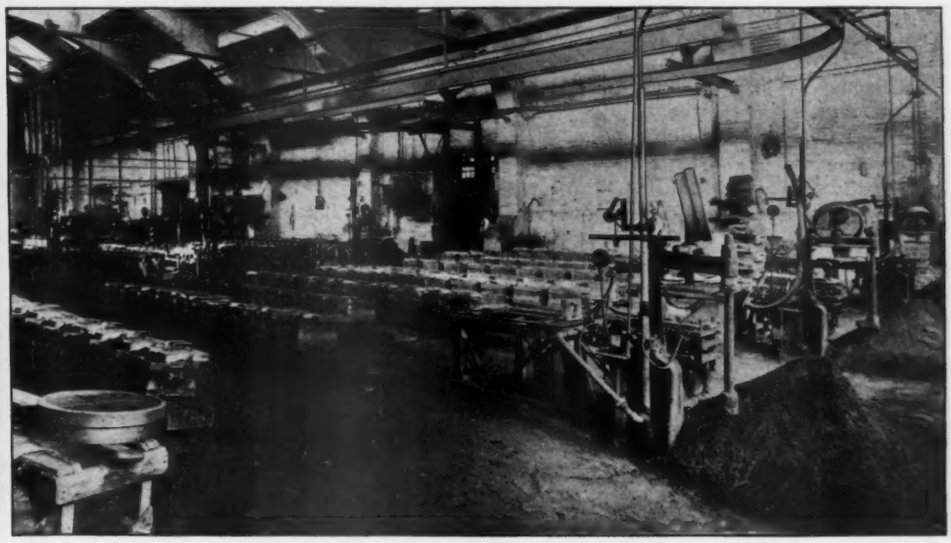


FIG. 6—MACHINE EQUIPPED FOR MOLDING MOTORCYCLE CARBURETORS. FIG. 7—GENERAL VIEW OF CARBURETOR MOLDING DEPARTMENT OF LANKSENKAMP & WHEELER BRASS FOUNDRY

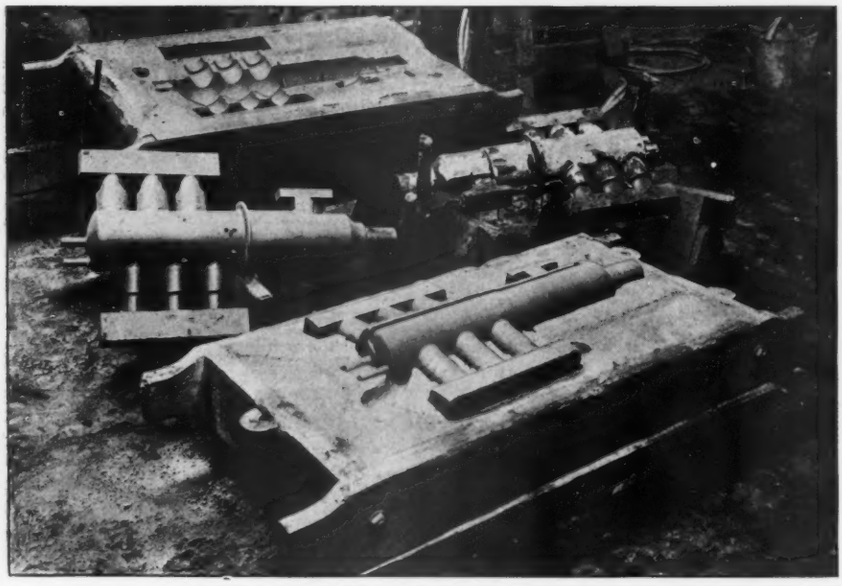


FIG. 8—A HEAVY BRASS STEAM-HEADER FOR CATSUP COOKERS MOLDED ON THE FLOOR

set on boards laid across the flanges of the channel. The concrete benches are of the type shown at the right in Fig. 4. The arrangement of the cores in the molds and the method of gating the castings is shown clearly in Fig. 4. When the molds are poured they are held down by weights 2 inches thick and 12x16 inches in area. These weights are notched to take care of the runners and risers. Each weight also is fitted with two handles to facilitate shifting and placing.

As previously described, the work is handled by tasks and this method is clearly indicated in Figs. 3 and 4. Fig 3 shows a group of copes which have just been made on the machine. A load of cores is shown in the background and the condition of the sand heap is clearly evident. In Fig. 4 it will be noted that some of the molds have already been poured and are ready to be shaken out. Another row of molds with the cores set is ready for closing.

The government is purchasing a large number of motorcycles for dispatch work in connection with the operation of the armies in France. These motorcycles are provided with small carburetors of the type shown in Figs. 5 and 6. Six carburetor bodies are cast in one 12-x16-inch flask and the operator turns out over 100 molds per day. Each casting is gated at two points and the same pattern-plate is used for molding both copes and drags. The drags, which are made in small groups, are first laid out on a bench where the cores are set before the flasks are transferred to the floor for closing. The general arrangement of a floor of motorcycle carburetor molds is clearly shown in Fig. 5, which also illustrates the castings as they come from the mold after being sand blasted.

An appreciation of the wide variety of work turned out at the Langsenkamp & Wheeler plant may be obtained by contrasting the small motorcycle carburetor castings, shown in Figs. 5 and 6, with the heavy brass header or manifold shown in Fig. 8. This header forms part of a steam heating coil for a catsup cooker. The casting weighs 82 pounds finished. It is made in a green-sand mold which is rammed up on the floor by hand. The flask is 22½x42 inches in size, the drag being 6 inches and the cope 11½ inches in depth. The mold is skin-dried with a gas flame. The small molds containing carburetor parts are poured green. A wooden pattern, shown at the left in Fig. 8, is employed and the interior of the casting is formed by a heavy dry sand core. This core is carefully made in two parts, the header being provided with a dividing wall. The mold is poured two-up through 1½-inch runners at either end. There is one 1¼-inch riser, located as shown on the rough casting at the right in Fig. 8. A molder and helper turn out eight molds per day.

The melting equipment at the Langsenkamp & Wheeler plant is unusually complete. A corner in the melting room is shown in Fig. 9. Three 1200-pound oil-burning furnaces of the Lunkenheimer type, developed by the Lunkenheimer Co., Cincinnati, are employed for melting red brass. In addition, an 8-hole oil-burning crucible furnace of the Kroeschell type is installed, together with eight standard coke holes and a 16-hole crucible-type producer gas furnace.

In normal times, practically all of the metal is melted in crucibles with producer gas. Westinghouse producers aggregating 350-horsepower have been installed. These producers not only furnish gas for melting purposes, but also a surplus for use in gas engines for the generation of electricity. With coal at $4 a ton and crucibles at a normal price the melting cost using producer gas was approximately 9 cents per hundred pounds. At present, however, it is exceedingly difficult to obtain coal of suitable quality for producer use and in addition crucibles are high. Therefore an unusually large amount of metal is melted in the Lunkenheimer furnaces and in the oil-burning crucible furnaces. Japanese crucibles are now being used extensively and up-to-date they have proved entirely satisfactory, showing a life of 20 to 25 weeks.

The charges for the Lunkenheimer furnaces are weighed out into coal scuttles which are emptied into the furnace through a heavy funnel inserted in the charging hole. The Lunkenheimer fur-

FIG. 9—A CORNER IN THE MELTING DEPARTMENT SHOWING OIL-FIRED CRUCIBLE FURNACES AND OIL-BURNING TILTING FURNACES

naces are operated continuously, turning out heats ranging from 1000 to 1200 pounds. It requires about 1¾ hours to melt the first heat in the morning. The succeeding heats are melted in 1½ hours. The carburetor parts and other castings made at the Langsenkamp & Wheeler plant are all finished by sand-blasting. A 36 x 46-inch sand-blast tumbling barrel built by the New Haven Sand Blast Co., New Haven, Conn., has been installed for handling this work. This machine has sufficient capacity to take care of the entire output of the plant. The general arrangement of the sand-blasting apparatus, together with one of the sprue cutters and a portion of the inspection bench for small castings is shown in Fig. 10. In order to give the castings a high finish, an air pressure of 60 pounds per square inch is employed in sand blasting. The machine has a capacity ranging from 300 to 500 pounds, depending on the size of the castings, and each batch is blasted for from 15 to 20 minutes. The cores are knocked out prior to sand blasting. The molding room at the Langsenkamp & Wheeler plant is 50 feet in width and 235 feet in length. It is served by a traveling crane of five tons capacity which is used for handling occasional heavy work. As previously mentioned about eight tons of metal are poured daily and this work is handled in the molding and melting departments by 21 men. The firm of Langsenkamp & Wheeler was organized originally in 1895 under the name of Langsenkamp Bros. About 12 years ago F. H. Wheeler joined the firm and the present corporation was organized. The officers of the company now include F. H. Wheeler, president; William Langsenkamp, vice president and Henry Langsenkamp, secretary-treasurer.

FIG. 10—ALL THE CASTINGS ARE SAND BLASTED WITH AIR AT A PRESSURE OF 60 POUNDS PER SQUARE INCH

PROBLEMS OF THE BRASS FOUNDER

What To Do and How To Do It

Making Highly Leaded Alloys

We are having trouble making an alloy of copper, 60 per cent; tin, 5 per cent and lead, 35 per cent, to which we add 0.10 per cent phosphor-copper. We melt the copper first, add the phosphor-copper, then the tin and last the lead; the metal is stirred all the time that the lead is being added. We pour as soon as the metal reaches the proper temperature, but the castings are full of holes that look like dross.

In making leaded alloys in which the lead is the predominating part of the mixture, phosphorous should never be used. Thirty-five per cent of lead is too much to hold in solution with 5 per cent tin; the lead should be reduced to 30 per cent and the copper increased to 65 per cent. As an aid in retaining the lead it is advisable to incorporate 1 per cent of nickel in place of the same amount of copper. The alloy, therefore, would be copper, 64 per cent; nickel, 1 per cent; tin, 5 per cent and lead, 30 per cent. If 35 per cent of lead is required the tin will have to be reduced and better results will be obtained if it is left out entirely. Considerable difficulty will probably be experienced in making such alloys, but repeated trials undoubtedly will be crowned with success. It is not easy to make highly-leaded copper alloys. Fluxes appear to be a necessity, but they vary so greatly that almost any of the substances used in foundries can be used. The addition of 1 per cent sulphur sometimes gives good results.

Uniform Color on Brass Ingots

We understand that to obtain a uniform color on brass ingots it is necessary to coat the molds with some preparation.

To get a uniform color on the surface of the ingots, they should be dumped into water while still red hot. The ingot molds are given a light coat of lard oil, just enough to flash off as the metal strikes the iron. The ingots should be mounted in such a manner that by the turn of a crank the molds can be inverted into a shallow tank of clean, cold water, in the same manner that copper ingots are treated.

If the ingots are left to cool in the molds, as they cool they shrink away from the iron and the air gets to the brass and oxidizes it more or less, producing variations of color on the surface of the ingots. When the latter are dumped into water, the steam that is immediately formed scales the surface of the ingot, exposing the brighter surface underneath.

The claim has been made that simply painting the inside of the ingot molds with aluminum paint, results in the production of clean, bright ingots. This claim, however, we cannot substantiate, from personal experience.

Casting a Chromium-Nickel Alloy Successfully

We are making heavy castings from a chromium-nickel alloy. The metal cuts into the sand, not only at the gates, but sometimes as much as 12 to 18 inches from the gates. We are using Albany, Zanesville, French, Windsor Locks and also silica sand, and pour the molds both skin-dried and green, with poor results. How may this trouble be overcome?

The sands used are not sufficiently refractory for this alloy, as its melting point is much higher than that of the metals usually cast in such molds. Use a facing of pure silica sand; the whiter it is the better it is for the purpose, and to give this sand *body* mix with it a proportion of good fireclay. Mix enough fireclay to give the sand the same adhesiveness as the molding sand, and if possible, mill the facing to thoroughly incorporate the clay. Wet the sand with molasses water and use this mixture as a facing, backing it with molding sand that is sufficiently free to allow the gases to escape freely. Do not mix molding sand with the silica sand, as such an admixture will lower its melting point. For a facing on the molds use silica wash, such as employed in steel foundries, and mix the silica wash with molasses water to the consistency of cream. Spray this onto the molds and skin-dry them with a torch, or by spraying with gasoline and afterwards igniting. Cutting around the gates can be prevented by spraying with a 10 per cent silicate of soda and water mixture, drying afterwards.

How to Prevent Spongy Brass Castings

We have experienced considerable trouble in casting bronze pump bushings. This is caused by a condition of sponginess that develops after the bushings are machined. We pour the castings on end, and gate them from the bottom and center. The mold is well vented and is coated with plumbago mixed with molasses water, painted on and dried. We place a big riser on the top end and flow-off from 75 to 100 pounds of metal. The mold is made in a pit and is poured with one big ladle. The metal consists of 400 pounds of red brass scrap and copper wire, and this is alloyed with tin, lead and zinc to make a 1 to 16 alloy. We also add 1 pound of phosphor tin to clean the metal. The castings weigh from 5 to 800 pounds and the metal is melted in a gas furnace.

There is a possibility that the difficulty is caused by the copper wire, and to test this, use ingot copper in a few heats. If the castings come bad with the wire, even if the latter is much cheaper than the ingot copper, the latter should be used. In melting, whether ingot or wire, the best practice is to put the brass in the pot with the copper. If the copper can be packed in the bottom of the pot to best advantage, this can be done and the brass placed on top. Use about half brass and half copper, add a little salt and some hardwood blocks and melt quickly. When the metal is all down there should be clear metal under a cover of charcoal; let it get hot and add more wire, being careful not to chill the metal that is molten. Place brass on top after adding the wire, then a wood block or two and again melt. When all is melted, add the tin, zinc and lead, and stir well. Just before removing from the furnace, add the phosphor tin, and stir again. If the brass is poured into a ladle, be careful to have it dry, for if the lining is green enough to cause the brass to bubble and simmer, the castings will probably be porous, regardless of how carefully the bronze has been melted.

Overcoming Pitting in Copper Castings

We are making small copper gears, 3 inches in diameter. After they are machined the castings develop pits, especially on the cope side. We pour the metal at a very high temperature, and are at a loss to account for this difficulty.

It is not surprising that the copper castings are pitted or spongy, as copper invariably casts in this manner if means are not taken to deoxidize it before it is poured into the molds. Also, some deoxidizers, such as phosphorous, while they are able to eradicate sponginess, cause pits to form on the external surface of the castings. In this case, however, the pits will be on the drag side of the casting, and the fact that in this instance the pits are in the cope would indicate that phosphorous is not being used as a deoxidizer. If no deoxidizer is being employed, it will be necessary to add one to the copper, and in this case the easiest one to use is zinc. It will be necessary to add from 3 to 4 per cent zinc to insure sound castings, but if a purer copper than this is required, make an alloy of 50 per cent copper and 50 per cent zinc. If phosphor-copper is available, add 1 per cent to the copper before adding the zinc; stir well and pour into small ingots. Add 2 per cent of his alloy to the copper just before it is removed from the furnace to be poured. In melting the copper use a little salt as a flux and about 1 inch of fine charcoal.

How Electrolytic and Casting Copper Differ

We expect to close a contract for our copper requirements covering quite an extended period and we would like to know the difference between electrolytic and casting copper. Also advise us, if possible, which grade should be purchased for the manufacture of castings for pulp and paper mill machinery.

The standards for new metals specify electrolytic copper as copper refined by the electrolytic process, containing 99.93 per cent copper and upwards, for use as cathodes. The conductivity must be 103 per cent. Casting copper must analyze from 99 to 99.75 per cent copper and must be made from ore and scrap metal. It is used for casting purposes. Electrolytic copper is the only class of this metal that should be used for making copper castings of high electrical conductivity and for aluminum bronze, because it contains no impurity injurious to the quality of the metal produced therefrom. For brass and bronze castings, the casting grade of copper is satisfactory, but unless it can be obtained at a price below that of electrolytic, it is advisable to purchase the latter, as it has a higher percentage of purity. Impurities can readily be introduced into copper, such as arsenic, phosphorus, oxygen and other elements, but it is difficult to remove them. Therefore, if there is no price difference in favor of the grade of copper containing the high percentage of impurities, and if no difficulty is experienced in obtaining the purest grade, it always is advisable to choose a copper containing the least amount of impurities.

Glass as Flux for Oil-Fired Furnaces

On account of the difficulty of getting coke we recently installed a gas-fired furnace for melting brass, but have experienced trouble as the metal appears to get mushy, as if it were burned.

One successful gas-fired furnace now being manufactured is equipped with three burners arranged equidistant around the base of the furnace, in such manner that the flame is projected into the furnace at a tangent. The result is that the flame whirls around the crucible and finds exit from a vent in the furnace cover. This furnace is efficient and will melt copper or nickel. Blast is furnished by a pressure blower.

It is possible that in the present case the proportions of gas and air are not properly adjusted, and we suggest that experiments be made to determine this. As charcoal cannot be kept on the surface of the metal as a protection, it will be necessary to use a flux that will melt to a liquid. Use common bottle glass as a flux and a little salt.

Milwaukee Welcomes Great Army of Foundrymen

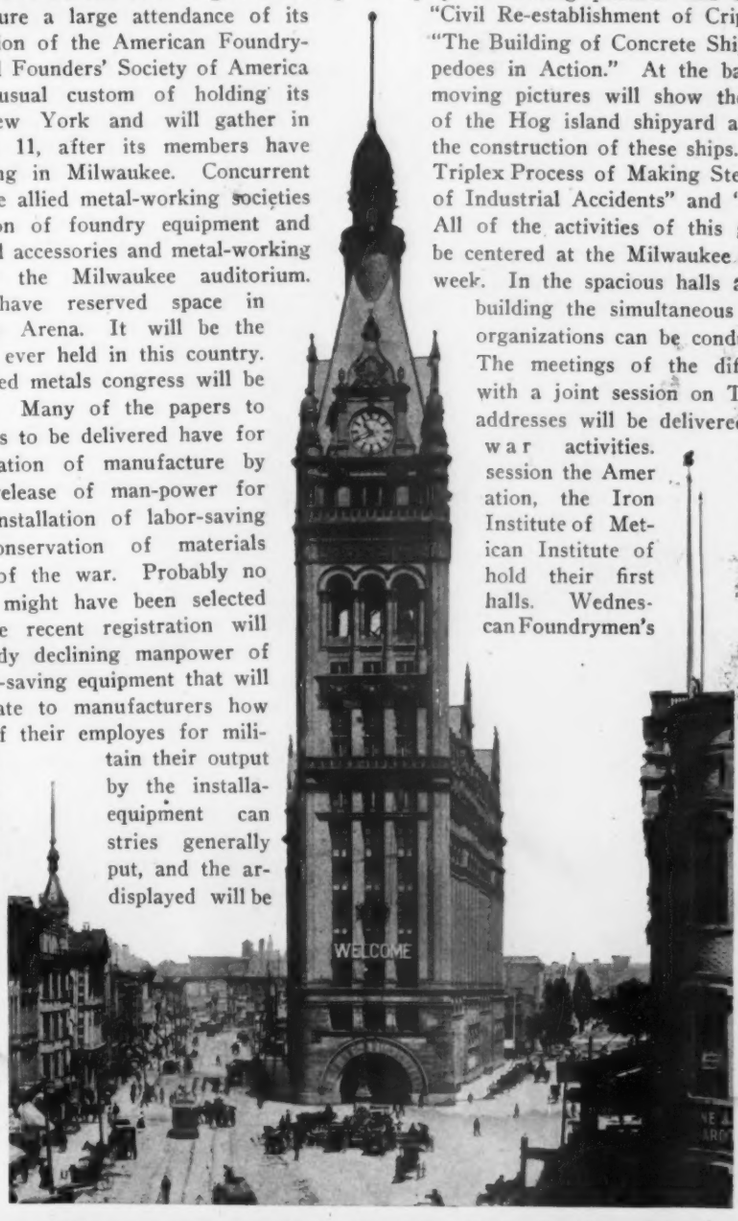
"Winning the War" and "The Conservation of Man-power", Will be the Keynotes of the Great Gathering of Manufacturers Representing the Metal-Working Industries of the Country

AFTER an elapse of 15 years, Milwaukee, during the week of Oct. 7, again will be host to the great army of North American foundrymen. In 1903 the American Foundrymen's association met in Milwaukee and at that time the attendance was counted by a few hundred. This coming event, however, will be attended by from 3000 to 4000 men engaged in the metal-working industries whose sole aim is the winning of the war. In addition to the twenty-third convention of the American Foundrymen's association, the American Institute of Mining Engineers, Iron and Steel section, will hold its 118th meeting during that week and the Institute of Metals division of that society, formerly the American Institute of Metals, will likewise gather at that time. Furthermore, the American Malleable Castings association will hold one of its regular meetings in Milwaukee and to insure a large attendance of its members at the steel session of the American Foundrymen's association, the Steel Founders' Society of America has departed from its usual custom of holding its monthly meetings in New York and will gather in Chicago on Friday, Oct. 11, after its members have attended the great meeting in Milwaukee. Concurrent with the meetings of these allied metal-working societies will be held an exhibition of foundry equipment and supplies, machine tools and accessories and metal-working machinery generally, in the Milwaukee auditorium. Nearly 200 exhibitors have reserved space in Machinery hall and the Arena. It will be the greatest show of its kind ever held in this country.

The keynote of this allied metals congress will be the winning of the war. Many of the papers to be presented and addresses to be delivered have for their theme the accelleration of manufacture by improved methods, the release of man-power for military service by the installation of labor-saving equipment and the conservation of materials needed for the conduct of the war. Probably no more psychological time might have been selected for this exhibition. The recent registration will greatly deplete the already declining manpower of the country and the labor-saving equipment that will be shown will demonstrate to manufacturers how they may release some of their employes for military service and still maintain their output at present capacity. Only by the installation of labor-saving equipment can the metal-working industries generally put, and the array of equipment to be displayed will be a demonstration of how machine-power can compensate for the waning man-power of this country.

One of the unusually interesting features of this exhibition will be a display of war equipment to be made under the auspices of the ordnance section of the war department. It will include a field gun, machine guns of various types, shells, hand and rifle grenades and other missiles of warfare. The great majority of the manufacturers who will attend this show will have an opportunity to see for the first time the assembled product for which they are engaged in making parts in their plants throughout the country.

The program of moving pictures, all of which have a bearing on some phase of industry, never before has been remotely approached. It will include military films to be shown by Maj. Frank B. Gilbreth in his address on "Modern Methods of Transferring Skill," in which the assembling of the Browning gun and the use of hand grenades will be illustrated. One afternoon will be devoted entirely to the display of moving pictures and the various topics include "Civil Re-establishment of Crippled Soldiers in Canada," "The Building of Concrete Ships," "Submarines and Torpedoes in Action." At the banquet on Thursday night, moving pictures will show the tremendous development of the Hog island shipyard and the use of castings in the construction of these ships. Other films include "The Triplex Process of Making Steel," "Cause and Prevention of Industrial Accidents" and "Gas and Flame Warfare." All of the activities of this great metals congress will be centered at the Milwaukee auditorium throughout the week. In the spacious halls afforded by this exposition building the simultaneous meetings of the various organizations can be conducted without interference. The meetings of the different societies will open with a joint session on Tuesday morning, at which addresses will be delivered, all having a bearing on war activities. At the close of this joint session the American Foundrymen's association, the Iron and Steel section and the Institute of Metals division of the American Institute of Mining Engineers will hold their first meetings in separate halls. Wednesday morning the American Foundrymen's association will have simultaneous sessions, one for the discussion of general topics and the other will be devoted exclusively to the consideration of safety, sanitation and accident prevention in industrial plants. Simultaneously, the Institute of Metals division and the Iron and Steel section of the American Institute of Mining Engineers will hold separate meetings. On Wednesday afternoon the Institute of Metals division will have another meeting and simultaneously a series of moving pictures will be shown in one of the large halls of



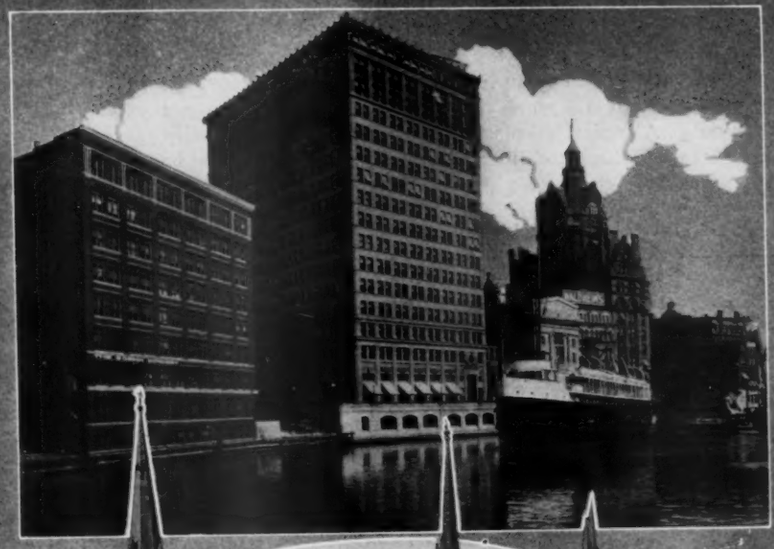
MILWAUKEE EXTENDS A HEARTY WELCOME TO ALLIED METALS CONGRESS

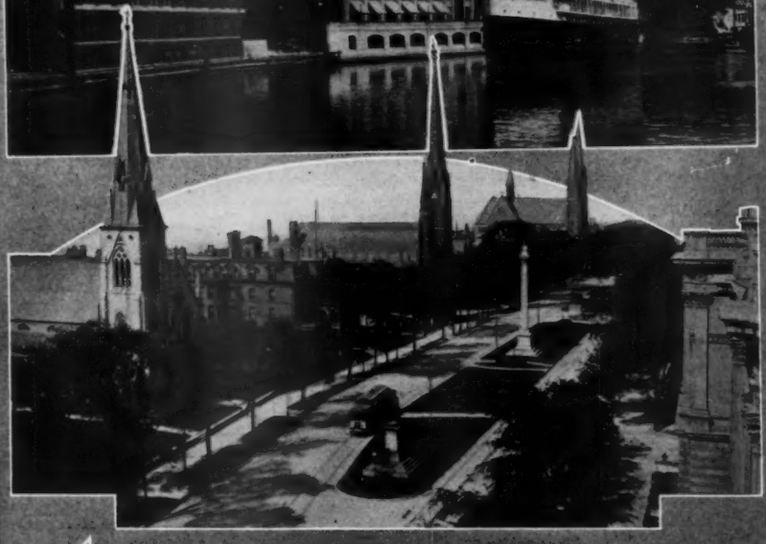
the Milwaukee auditorium. On Thursday morning the gray iron, steel and malleable sections of the American Foundrymen's association will hold simultaneous meetings and the closing session of the Institute of Metals division also is scheduled for that time. The final professional session of the American Foundrymen's association will be held on Friday morning.

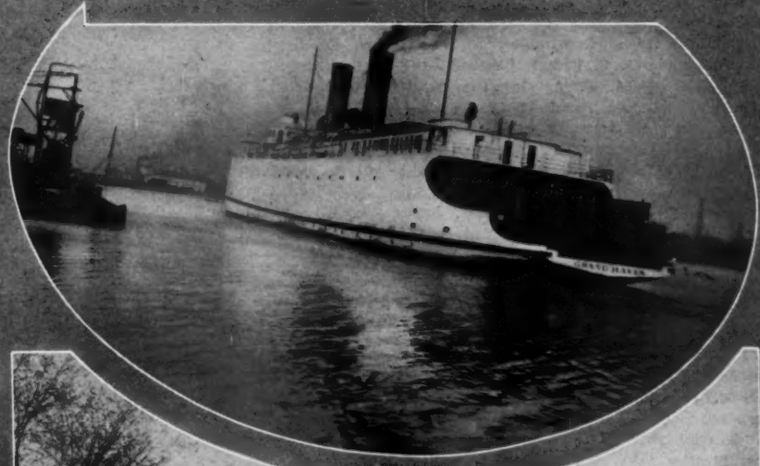
A large number of noteworthy papers will be read and many addresses will be delivered on topics relating to problems arising from war activities. C. S. Koch, of the cannon division of the war department, will discuss the activities of the army ordnance department, especially as applying to foundry matters and E. D. Brigham, manager iron ore, coal

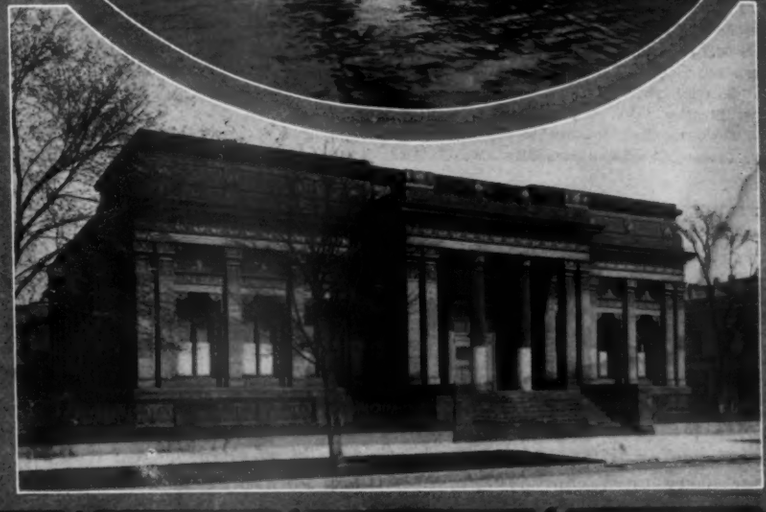
ALTHOUGH MILWAUKEE IS ONE OF THE LEADING INDUSTRIAL CENTERS OF THE COUNTRY AND RANKS HIGH AMONG THE FOREMOST METAL WOR CITIES,

and grain traffic of the United States railroad administration, will deliver an address on "Co-operation between the Railroad Administration and the Foundry Industry." "Women in the Foundry," is the title of the paper to be read by C. E. Knoeppel, C. E. Knoeppel & Co., New York, and Charles J. Stark, editor of THE IRON TRADE REVIEW, will deliver a paper entitled "Sale and Distribution of Foundry Pig Iron in War Times," in which every foundryman will be vitally interested. W. A. Janssen, manager, Canadian Steel Foundries, Ltd., Montreal, will deliver an address on "The Problems of the Returned Soldiers" and "Cast Iron in Service Projectiles in Trench Warfare" will be the subject of an address by Maj. Edgar Allen Custer of the Pittsburgh district ordnance depart-









CITIES, THE PARKS, PUBLIC AND PRIVATE BUILDINGS, WELL-KEPT STREETS, ETC., REFLECT THE GREAT CIVIC PRIDE OF THIS COMMUNITY

ment. "The Manufacture of Ordnance Steel for the Army and Navy" and "Meeting Specifications for Army Ordnance Steel Castings," are the subjects of two vitally important papers of interest today to all steel casting manufacturers. A topical discussion of ordnance steel problems will follow the presentation of these two papers. A "Symposium on the Conservation of Tin," is one of the features of the Institute of Metals program.

An entertainment program which measures up to the hospitality for which Milwaukee is noted has been outlined and includes an automobile sightseeing trip, luncheons and card parties for the ladies, reception, concert and dance on Tuesday night and a theater party on Wednesday night.

The annual banquet to be held in the Milwaukee auditorium on Thursday evening will allow the members attending an exceptional opportunity to hear speakers of international fame. Charles M. Schwab, director general of the Emergency Fleet corporation, has consented to set aside sufficient time to come to Milwaukee to deliver an address at this banquet. Maj. A. Radclyffe Dugmore, who has just returned from the front, will describe war conditions from first hand knowledge. W. H. Blood, Jr., of the American International Shipbuilding Corp., Philadelphia, will deliver an illustrated address on the Hog island shipyard.

Plant visitation will be confined to Thursday and Friday, Oct. 10 and 11. On both days guests desiring to participate in plant inspection will gather at the Milwaukee auditorium at 8:30 a. m. and 1:30 p. m., and will board private cars for the plants of the Allis-Chalmers Mfg. Co., Kearney & Trecker Co., Falk Co., Chicago, Milwaukee & St. Paul railroad shops, Wisconsin Gun Co., Sivyer Steel Casting Co., Pawling & Harnischfeger Co., Northwestern Malleable Iron Co., Vilter Mfg. Co. and Filer & Stowell Co. In addition, a number of other large plants have signified their willingness to receive visitors on plant visitation days which are designated.

Milwaukee may be proud of its record and standing as a great foundry center. Sixth in number of foundries in the United States, Milwaukee ranks second to none in the patriotism of deeds. The unearned stigma which was reflected by utterances of politicians has been obliterated by tons of metal and hours of toil dedicated to American victory. The metal-working trades which form the

Program, American Foundrymen's Association

Monday, Oct. 7

10:00 A. M.—Registration, Milwaukee Auditorium.
1:00 P. M.—Opening of exhibition, Milwaukee Auditorium.

Tuesday, Oct. 8

10:00 A. M.—Joint opening session, American Foundrymen's Association, Iron and Steel Section and Institute of Metals Division, American Institute of Mining Engineers, Plankinton hall, Milwaukee Auditorium, Benj. D. Fuller, chairman, president of the American Foundrymen's Association.

Address of welcome, by Hon. Emanuel L. Phillipp, governor of Wisconsin, Madison, Wis.

Response to the address of welcome, by Benj. D. Fuller, president of the American Foundrymen's Association.

"Activities of the Army Ordnance Department, Especially as Applied to Foundry Matters," address by C. S. Koch, Cannon Division, War Department, Washington, D. C.

"Co-operation between the Railroad Administration and the Foundry Industry," address by E. D. Brigham. manager iron ore, coal and grain traffic, United States Railroad Administration, Duluth.

"Modern Methods of Transferring Skill," illustrated by military films, address by Major Frank B. Gilbreth, Providence, R. I.

11:30 A. M.—Professional session, Plankinton hall.

Annual address by Benj. D. Fuller, president American Foundrymen's Association.

Report of the board of directors of the American Foundrymen's Association, Inc.

Report of the secretary-treasurer of the American Foundrymen's Association, Inc., by A. O. Backert, Cleveland.

Report of the A. F. A. Committee on Foundry Costs, by J. Roy Tanner, Pittsburgh Vale, Foundry & Construction Co., Pittsburgh.

Appointment of nominating committee and committee on resolutions.

Afternoon—Automobile sightseeing tour for the ladies with luncheon at the plant of the Schlitz Brewing Co., which will be served by the courtesy of this company.

Evening—Reception, concert and dance, Juneau hall, Milwaukee Auditorium. Light refreshments will be served and handsome souvenirs will be given to the ladies.

Wednesday, Oct. 9

General Topics

10:00 A. M.—Professional session, American Foundrymen's Association, Plankinton hall.

Benj. D. Fuller, chairman, president of the American Foundrymen's Association.

"Selecting the Sand Blast Equipment for the Foundry," by H. D. Gates, Pangborn Corp., Hagerstown, Md.

"Engineers—Their Relation to the Foundry in the Saving of Labor," E. S. Carman, Cleveland Osborn Mfg. Co., Cleveland.

"Women in the Foundry," by C. E. Knoeppel, C. E. Knoeppel & Co., New York.

"Cottrell Precipitation Process and its Application to Foundry Dust Problems," by H. D. Egbert, Research Corp., New York.

"The Commerce of Coke," by J. A. Galligan, Pickands, Brown & Co., Chicago.

"Sale and Distribution of Foundry Pig Iron in War Times," by C. J. Stark, editor, *The Iron Trade Review*, Cleveland.

"Ferruginous and Other Bonds in Molding Sands," by Prof. P. S. H Boswell, Imperial College of Science and Technology, South Kensington London, England.

Report of nominating committee and election of directors of the American Foundrymen's Association, Inc.

Session on Safety and Accident Prevention

10:00 A. M.—Professional session, American Foundrymen's Association, committee room A.

Victor T. Noonan, chairman, Director of Safety, Industrial Commission of Ohio, Columbus, O.

"What the State can do to Prevent Accidents," address by Hon. Thomas J. Duffy, chairman, Industrial Commission of Ohio, Columbus, O.

"Accident Prevention is Good Business," address by Fred M. Wilcox vice president, Industrial Commission of Wisconsin, Madison, Wis.

Report of the A. F. A. committee on Safety, Sanitation and Fire Prevention, by Victor T. Noonan, chairman, Director of Safety, Industrial Commission of Ohio, Columbus, O.

"Problems of the Returned Soldiers," by W. A. Janssen, Canadian Steel Foundries, Ltd., Montreal.

"The Personal Interest of the Employer is Necessary in Accident Prevention," by Victor T. Noonan.

"The Vital Importance of Industrial Accident Prevention in War Times," by Victor T. Noonan.

"An Accident Prevention Campaign in an Open-Hearth Steel Foundry with the Aid of Safety Committees," by F. G. Barnett, Director of Safety. Buckeye Steel Castings Co., Columbus, O.

"Cause and Prevention of Industrial Accidents," moving pictures to be shown, by Victor T. Noonan.

"Safety and Efficiency, Facts and Figures," by C. W. Price, field secretary, National Safety Council, Chicago.

12:00 M.—The ladies will be served a Dutch lunch at the Schlitz palm garden. In addition to an orchestra, several noted speakers will be on the program.

Moving Pictures

3:00 P. M.—Plankinton hall.
Moving pictures on the construction of concrete ships.
Moving pictures on the civil re-establishment of crippled soldiers.
Submarines in action.
Torpedoes in action.
8:00 P. M.—Theater party, Majestic vaudeville house.

predominate industry are rendering invaluable service at this time, and the fact that the number of foundries in Milwaukee has increased by practically 36 per cent since the United States entered the war is only an indication of the seriousness and sincerity with which this city assumes wartime responsibilities. Few cities are so plentifully supplied with the means for complete machinery production, and are so entirely self-contained in manufacture as Milwaukee. Despite the extensive foundry facilities, the machine shop capacity can handle practically all of the castings produced within its territorial limits.

One naturally seeks the reason back of such a preponderance of metal industries. That in this city, remote from the coal fields, the foundry industry should have experienced such tremendous growth is extraordinary. The answer lies in the character of the demand rather than in the availability of raw material supplies. It is a case of the mountain come to Mohammed. The early history of the city, dating back to the early forties, is identified with peculiar economic conditions. A natural harbor afforded outlet for grain and timber across the lakes to earlier established eastern centers. The market for mill machinery in western New York and parts of Ohio was saturated, and the business insight of a few pioneer machinery manufacturers suggested that grain and timber could better be shipped as flour and lumber. The result was a few small plants making mill machinery in the early '40s. These developed foundries early in their progress and formed the nucleus of the present day foundry center in Milwaukee.

In no locality is the principle of repeated expansion better demonstrated. Few of the present great foundry interests of Milwaukee had a topsy-like origin. In almost every case the present manufacturing concerns are a development, an expansion, a branch, or an outgrowth of some early plant. Practically without exception each concern was founded through someone, brought up and trained within another and older organization; and this process of de-

Program, American Foundrymen's Association

(*Concluded from page* 474)

Thursday, Oct. 10

Gray Iron Session

10:00 A. M.—Professional session, American Foundrymen's Association, Plankinton hall.

Benj. D. Fuller, chairman, president of the American Foundrymen's Association.

"The Continuous Two-story Foundry," by J. F. Ervin, Michigan Motor Castings Operating Co., Flint, Mich.

"Organizing a Foundry for the Economical Production of Gray Iron Castings," by Paul R. Ramp, Campbell, Wyant & Cannon, Muskegon, Mich.

"Cast Iron in Service Projectiles and Trench Warfare," address by Major Edgar Allen Custer, Pittsburgh District Ordnance Department, Pittsburgh.

"The Use of Positive Displacement Blowers in Cupola Practice," by W. Trinks, Carnegie Institute of Technology, Pittsburgh.

"Recent Developments in Burning Oil in Cupolas," by John Howe Hall, Taylor-Wharton Iron & Steel Co., High Bridge, N. J.

Report of A. F. A. Committee on General Specifications for Gray Iron Castings, by Richard Moldenke, Watchung, N. J.

"A Rapid Method for the Determination of Graphitic Carbon," by Frank H. Kingdon, Sullivan Machinery Co., Claremont, N. J.

Malleable Session

10:00 A. M.—Professional session, American Foundrymen's Association, Engelmann hall.

J. P. Pero, chairman, Missouri Malleable Iron Co., East St. Louis, Ill.

"Malleable Iron as a material in Engineering Construction," by H. A Schwartz, National Malleable Castings Co., Indianapolis.

"Experiments in Annealing Malleable Iron," by H. E. Diller, General Electric Co., Erie, Pa., with written discussion by P. Dressler, American-Dressler Tunnel Kilns Co., New York.

"A Modern Core Room," by Donald S. Barrows, T. H. Symington Co., Rochester, N. Y.

"Some Factors in the Manufacture of High Grade Malleable Iron Castings," by J. G. Garrard, Northwestern Malleable Iron Co., Milwaukee.

"The Integrity of the Casting," by Enrique Touceda, consulting engineer, Albany, N. Y.

Report of the A. F. A. Committee on Specifications for Malleable Iron Castings, by Enrique Touceda, Albany, N. Y.

"Advantages of Malleable Iron Versus Steel for Agricultural Castings," by P. A. Paulson, Rockford Malleable Iron Co., Rockford, Ill.

Steel Session

10:00 A. M.—Professional session, American Foundrymen's Association committee room A.

C. R. Messinger, chairman, Sivyer Steel Casting Co., Milwaukee.

"Ordnance Steel for the Army and Navy," by John Howe Hall, Taylor-Wharton Iron & Steel Co., High Bridge, N. J.

"Meeting Specifications for Army Ordnance Steel Castings," by Capt. E. R. Swanson, ordnance department, inspection division, Washington, D. C.

Topical discussion of ordnance steel problems will follow the presentation of the two foregoing papers.

"Making Steel Castings on the Pacific Coast," by J. D. Fenstermacher, Columbia Steel Co., San Francisco.

Report of the Committee on Steel Foundry Standards, by W. A. Janssen, chairman, Canadian Steel Foundries, Ltd., Montreal.

"The Electric Furnace in the Steel Foundry," by W. E. Moore, W. E. Moore & Co., Pittsburgh.

"The Advantages of the Basic Lining for Electric Furnaces," by F. J. Ryan, Electric Furnace Construction Co., Philadelphia, Pa.

Plant Visitation

Guests desiring to follow the regular plant visitation schedule are requested to meet at the Milwaukee Auditorium at 8:30 a. m. A private car will take them to the plant of the Allis-Chalmers Mfg. Co., and to the Kearney & Trecker Co. At 1:30 p. m. a private car will take the guests to the plant of the Falk Co. and the Chicago, Milwaukee & St. Paul railroad shops.

Afternoon—Card party and tea for the ladies in the Badger room, Wisconsin hotel. Handsome prizes will be awarded.

7:00 P. M.—Annual banquet, Milwaukee Auditorium.

Friday, Oct. 11

General Topics

10:00 A. M.—Professional session, American Foundrymen's Association, Plankinton hall.

Benj. D. Fuller, chairman, president of the American Foundrymen's Association.

"Effective Means of Improving the Quality of Foundry Sand Mixtures," by Henry B. Hanley, New London Ship & Engine Co., Groton, Conn.

"How Cost and Inspection Data are Secured in the Foundry of the Naval Gun Factory," by Lieut. Walter S. Doxsey, U. S. Navy Yard, Washington, D. C.

Report of the A. F. A. Committee advisory to the United States Bureau of Standards, by Richard Moldenke, Watchung, N. J.

"Pyrometers and their Application to Core Ovens," by G. W. Keller Brown Instrument Co., Philadelphia.

"Concrete Foundry Floors," by George Moyer, Textile Machine Works, Reading, Pa.

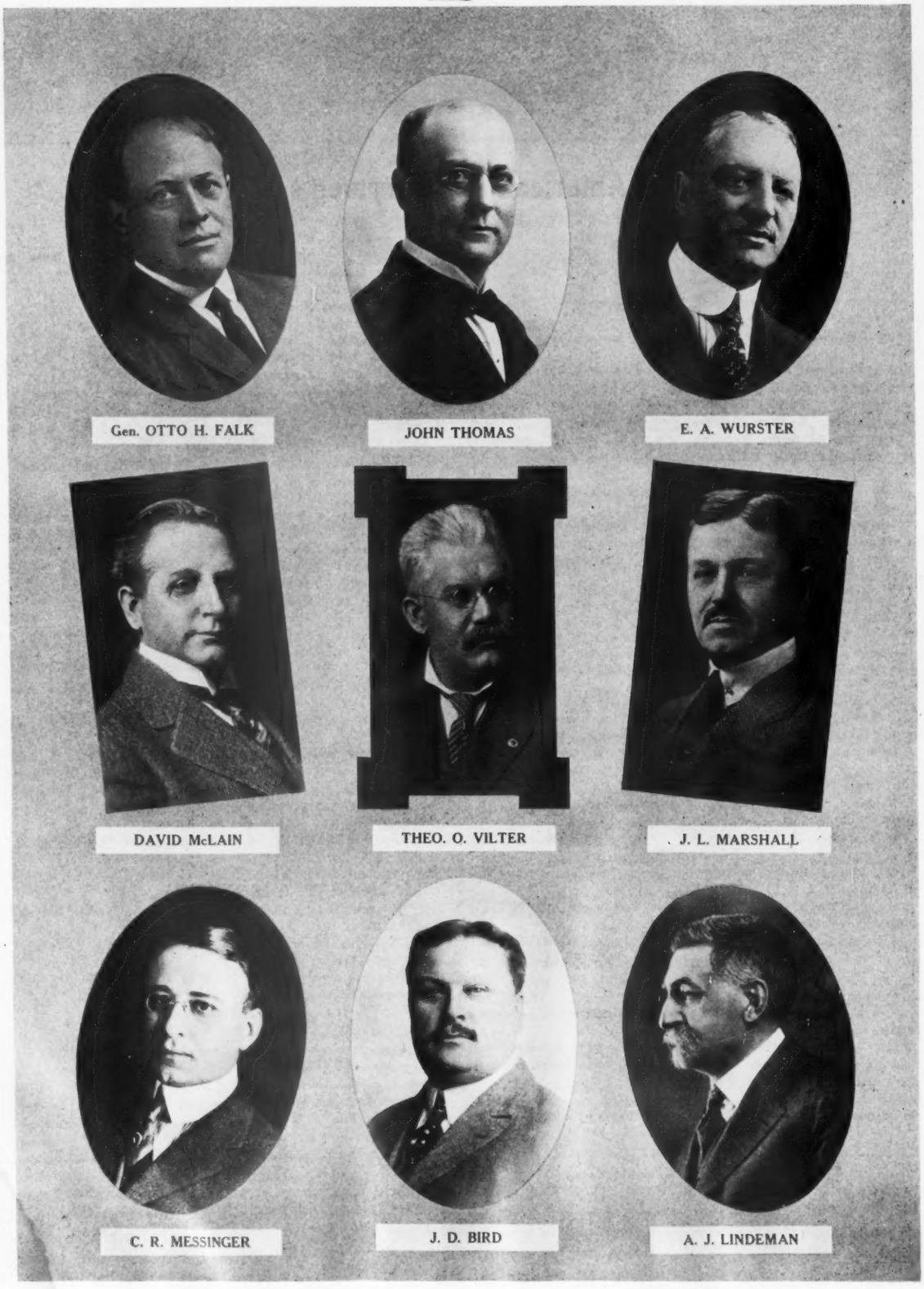
"A Pouring Device for Modern Foundries," by Mark P. Ohlsen, Brillion Iron Works, Brillion, Wis.

"Gas and Flame Warfare," shown in moving pictures.

Installation of officers.

Plant Visitation

A private car will leave the Milwaukee Auditorium at 8:30 a. m. for the plants of the Wisconsin Gun Co., Sivyer Steel Casting Co. and the Pawling & Harnischfeger Co. At 1:30 p. m. a private car will take the guests to the plants of the Northwestern Malleable Iron Co., Vilter Mfg. Co. and the Filer & Stowell Co.



SOME OF THE LEADING REPRESENTATIVES OF THE FOUNDRY AND METAL-WORKING TRADES OF MILWAUKEE, WHO ARE SERVING ON COMMITTEES TO RECEIVE AND ENTERTAIN THE VISITORS DURING THE WEEK OF OCT. 7

Program, Institute of Metals Division, A. I. M. E.

Monday, Oct. 7

10:00 A. M.—Registration, Milwaukee Auditorium.

1:00 P. M.—Opening of exhibition, Milwaukee Auditorium.

Tuesday, Oct. 8

10:00 A. M.—Joint opening session, American Foundrymen's Association, Iron and Steel Section and Institute of Metals Division, American Institute of Mining Engineers, Plankinton hall, Milwaukee Auditorium. Benj. D. Fuller, chairman, president of the American Foundrymen's Association. (See American Foundrymen's program for details.)

11:30 A. M.—Professional session, Institute of Metals Division, Kilbourn hall.

"The Metallography of Tungsten," by Zay Jeffries, Aluminum Castings Co., Cleveland.

"The Constitution of the Tin Bronzes," by S. L. Hoyt, University of Minnesota, Minneapolis.

Paper, title not given, by C. H. Matthewson, Sheffield Scientific School, Yale University, New Haven, Conn.

"Notes on Babbitt and Babbitted Bearings," by Jesse L. Jones, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

"Oxygen and Sulphur in the Melting of Copper Cathodes," by S. Skowronski, Raritan Copper Works, Perth Amboy, N. J., with discussion by Philip L. Gill.

"The Relation of Sulphur to the Overpoling of Copper," by S. Skowronski, with discussion by Philip L. Gill, metallurgical engineer, New York.

Afternoon—Automobile sight seeing tour for the ladies with luncheon at the plant of the Schlitz Brewery Co., which will be served by the courtesy of this company.

Evening—Reception, concert and dance, Juneau hall, Milwaukee Auditorium. Light refreshments will be served and handsome souvenirs will be given to the ladies.

Wednesday, Oct. 9

10:00 A. M.—Professional session, Kilbourn hall.

Symposium on "The Conservation of Tin." This topic will be discussed by the following:

C. W. Thompson, National Lead Co., New York.

G. H. Clamer, Ajax Metal Co., Philadelphia.

C. M. Waring, Pennsylvania Railroad Co.

M. L. Lissberger, Mark Lissberger & Son., Inc., Long Island City, N. Y.

D. M. Buck, American Sheet & Tin Plate Co., Pittsburgh.

W. M. Corse, Buffalo.

G. K. Burgess and Mr. Woodward, United States Bureau of Standards, Washington, D. C.

M. L. Dizer, War Industries Board, Washington, D. C.

Jesse L. Jones, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Noon—The ladies will be served a Dutch lunch at the Schlitz palm garden. In addition to an orchestra, several noted speakers will be on the program.

3:00 P. M.—Professional session, Kilbourn hall.

"The Volatility of the Constituents of Brass," by John Johnston, American Zinc, Lead and Smelting Co., St. Louis.

"Notes on the Metallography of Aluminum," by P. D. Merica, Bureau of Standards, Washington, D. C., and J. R. Freeman, Jr.

"The Effect of Impurities on the Hardness of Cast Zinc or Spelter," by G. C. Stone, New Jersey Zinc Co., New York.

"Dental Alloys," by Dr. Arthur W. Gray, L. D. Caulk Co., Milford, Del.

"Electrolytic Zinc," by C. A. Hansen, General Electric Co., Salt Lake City, Utah.

"The Condensation of Zinc from Its Vapor," by C. H. Fulton, Case School of Applied Science, Cleveland.

"The Action of Reducing Gases on Copper," by Norman B. Pilling.

8:00 P. M.—Theater party, Majestic vaudeville house.

Thursday, Oct. 10

10:00 A. M.—Professional session, Kilbourn hall.

"Notes on Non-Metallic Inclusions in Bronze and Brasses," by G. F. Comstock, Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

"Nichrome Castings," by Arlington Bengal, Driver-Harris Wire Co., Harrison, N. J.

"Fusible Plug Manufacture," by G. K. Burgess and L. J. Gurevich, Bureau of Standards, Washington, D. C.

Paper, title not given, by P. D. McKinney.

"Application of the Spectroscope to the Chemical Determination of Lead in Copper," by Messrs. Hill and Lucke.

"Radium," by Richard B. Moore, United States Bureau of Mines, Golden, Colo.

Plant Visitation

Guests desiring to follow the regular plant visitation schedule are requested to meet at the Milwaukee Auditorium at 8:30 a. m. A private car will take them to the plant of the Allis-Chalmers Mfg. Co. and to the Kearney & Trecker Co. At 1:30 p. m. a private car will take the guests to the plant of the Falk Co. and the Chicago, Milwaukee & St. Paul Railroad shops.

Afternoon—Card party and tea for the ladies in the Badger room, Wisconsin Hotel. Handsome prizes will be awarded.

7:00 P. M.—Annual banquet, Milwaukee Auditorium.

Friday, Oct. 11

A private car will leave the Milwaukee Auditorium at 8:30 a. m. for the plants of the Wisconsin Gun Co., Sivyer Steel Casting Co. and the Pawling & Harnischfeger Co. At 1:30 p. m. a private car will take the guests to the plants of the Northwestern Malleable Iron Co., Vilter Mfg. Co. and the Filer & Stowell Co.

Program, Iron and Steel Section, A. I. M. E.

Monday, Oct. 7

10:00 A. M.—Registration, Milwaukee Auditorium.

1:00 P. M.—Opening of exhibition, Milwaukee Auditorium.

Tuesday, Oct. 8

10:00 A. M.—Joint opening session, American Foundrymen's Association, Iron and Steel Section and Institute of Metals Division, American Institute of Mining Engineers, Plankinton hall, Milwaukee Auditorium. Benj. D. Fuller, chairman, president of the American Foundrymen's Association. (See American Foundrymen's program for details.)

Iron and Steel

11:30 A. M.—Professional session, Iron and Steel section, Engelmann hall.

"The Work of the National Research Council," by Henry M. Howe, chairman, engineering division, national research council, Washington, D. C.

"The Limonite Deposits of Mayaguez Mesa, Porto Rico," by C. R. Fettke, Carnegie Institute of Technology, Pittsburgh, and Be la Hubbard.

"The Manufacture of Ferro Alloys in the Electric Furnace," by R. M. Keeney, Ferro Alloy Co., Denver, Col.

"The Manufacture of Silica Brick," by H. LeChatelier, Paris, France, and B. Bogitch.

"Notes on Certain Iron-ore Resources of the World," New York Section Meeting of May 23, 1918.

"Recent Geologic Development on the Mesabi Iron Range, Minn." discussion by Anson A. Betts, Anson A. Betts & Co., Ashland, N. C. and J. F. Wolff, Oliver Iron Mining Co., Duluth.

Afternoon—Automobile sight seeing tour for the ladies with luncheon at the plant of the Schlitz Brewery Co., which will be served by the courtesy of this company.

Evening—Reception, concert and dance, Juneau hall, Milwaukee Auditorium. Light refreshments will be served and handsome souvenirs will be given to the ladies.

Wednesday, Oct. 9

Coal and Coke

10:00 A. M.—Professional session, Engelmann hall.

Moving pictures on the triplex steel process.

"The By-Product Coke Oven and its Products," by W. H. Blauvelt, Syracuse, N. Y.

"The Use of Coal in Pulverized Form," by H. R. Collins, Fuller Engineering Co., Allentown, Pa.

"Carbocoal," by C. T. Malcolmson, Malcolmson Briquet Engineering Co., Chicago.

"Low-temperature Distillation of Illinois and Indiana Coals," by G. W. Traer, Universal Coal Products Co., Chicago.

"Price Fixing of Bituminous Coal by the U. S. Fuel Administration," by Cyrus Garnsey, R. V. Norris and J. H. Allport.

12:00 M.—The ladies will be served a Dutch lunch at the Schlitz palm garden. In addition to an orchestra, several noted speakers will be on the program.

Moving Pictures

3:00 P. M.—Plankinton hall.

Moving pictures on the construction of Concrete Ships.

Moving pictures on the civil re-establishment of crippled soldiers.

Submarines in action.

Torpedoes in action.

8:00 P. M.—Theater party, Majestic vaudeville house.

Thursday, Oct. 10

The plant visitation schedule given in the program of the Institute of Meta's Division, preceding, will be followed.

Afternoon—Card party and tea for the ladies in the Badger room, Wisconsin Hotel. Handsome prizes will be awarded.

7:00 P. M.—Annual banquet, Milwaukee auditorium.

Friday, Oct. 11

The plant visitation schedule outlined in the preceding program will be followed.

ANOTHER GROUP OF REPRESENTATIVES OF THE MILWAUKEE FOUNDRY AND METAL-WORKING TRADES WHOSE COMMITTEE WORK INSURES A HEARTY WELCOME TO THE VISITORS

velopment goes back to the first few foundries.

Milwaukee's foundry industry was identified with several most interesting characters in the pioneer days. The first foundry in the city was started in 1843 by B. Bagnall & Co., and this became the nucleus for a larger plant which made castings for steam engines, and for the various classes of machines required in flour mill construction. The opening of the middle and northwestern wheat regions, and the gradual decline of the milling business in western New York brought to the west several men who became compelling forces. Among these was Capt. A. J. Langworthy who, with Nelson McCracken, became the founder of the Wisconsin Iron Works. This company passed through various vicissitudes culminating in the hard times of 1857, which led to the consolidation a few years later with a threshing machine company under the name of Kirby, Langworthy & Co. This partnership was broken up in 1869, and the foundry and machine shop holdings were sold to Filer & Stowell Co., who coincidentally established the Cream City Iron Works for the manufacture of saw and grist mill machinery.

The present Allis-Chalmers Mfg. Co., likewise grew through various stages starting with the manufacture of mill machinery. Stove manufacture, the establishment of a pipe foundry to meet an emergency, namely the construction of city water mains, and the addition of the present wide range of heavy machinery have all carried a remarkable foundry development.

Engine Building Enters

The Vilter Mfg. Co., builder of various types of steam engines and refrigerating machinery, was started in 1867. This company, founded by Peter Weisel, was carried forward by Theo. O. Vilter, who entered the old engine repair shop as an apprentice. This plant, which now employs about 125 men in its foundry alone, has constantly carried its foundry facilities in advance of its machine shop requirements and has always been able to take in outside work.

Another foundry established at a later date has been the progenitor of several of the most active of Milwaukee's manufacturing establishments. Fred W. Sivyer who was with the Northwestern Malleable Iron Co. in 1882, was the prime mover in these undertakings. The Northwestern malleable foundry was one of the first which was not set up as an adjunct to some machinery manufacturing plant. In 1891, with C. W. Levalley, Mr. Sivyer started a small plant for the manufacture of conveying machinery naming it the Chain Belt Co.

Condensed Program

Monday, Oct. 7

10:00 A. M.—Registration, Milwaukee Auditorium.

1:00 P. M.—Opening of the exhibition, Milwaukee Auditorium.

Tuesday, Oct. 8

10:00 A. M.—Joint session, American Foundrymen's Association, Institute of Metals Division and Iron and Steel Section of the American Institute of Mining Engineers, Plankinton hall, Milwaukee Auditorium.

11:30 A. M.—Opening session, American Foundrymen's Association, Plankinton hall.

11:30 A. M.—Opening session, Institute of Metals Division, American Institute of Mining Engineers, Kilbourn hall.

11:30 A. M.—Opening session Iron and Steel Section, American Institute of Mining Engineers, Engelmann hall.

Afternoon—Automobile sightseeing tour for the ladies.

Evening—Reception, concert and dance, Juneau hall, Milwaukee Auditorium.

Wednesday, Oct. 9

10:00 A. M.—Professional session, American Foundrymen's Association, Plankinton hall, for the discussion of general topics.

10:00 A. M.—Safety and Accident Prevention meeting of the American Foundrymen's Association, committee room A, Milwaukee Auditorium.

10:00 A. M.—Professional session, Institute of Metals Division, American Institute of Mining Engineers, Kilbourn hall.

10:00 A. M.—Iron and Steel section, American Institute of Mining Engineers, session on Coal and Coke, Englemann hall.

Noon—Luncheon for the ladies, Schlitz palm garden.

3:00 P. M.—Professional session, Institute of Metals Division, American Institute of Mining Engineers, Kilbourn hall.

3:00 P. M.—Moving pictures, Plankinton hall.

8:00 P. M.—Theater party, Majestic vaudeville house.

Thursday, Oct. 10

8:30 A. M.—Guests assemble at Milwaukee Auditorium for plant visitation.

10:00 A. M.—Gray Iron session, American Foundrymen's Association, Plankinton hall.

10:00 A. M.—Malleable session, American Foundrymen's Association, Englemann hall.

10:00 A. M.—Steel session, American Foundrymen's Association, committee room A.

10:00 A. M.—Professional session, Institute of Metals Division, American Institute of Mining Engineers, Kilbourn hall.

1:30 P. M.—Guests assemble at Milwaukee Auditorium for plant visitation.

Afternoon—Card party and tea for the ladies in the Badger room, Wisconsin Hotel.

7:00 P. M.—Annual banquet, Milwaukee Auditorium.

Friday, Oct. 11

8:30 A. M.—Guests assemble at Milwaukee Auditorium for plant visitation.

10:00 A. M.—Final professional session of the American Foundrymen's Association for the discussion of general topics, Plankinton hall.

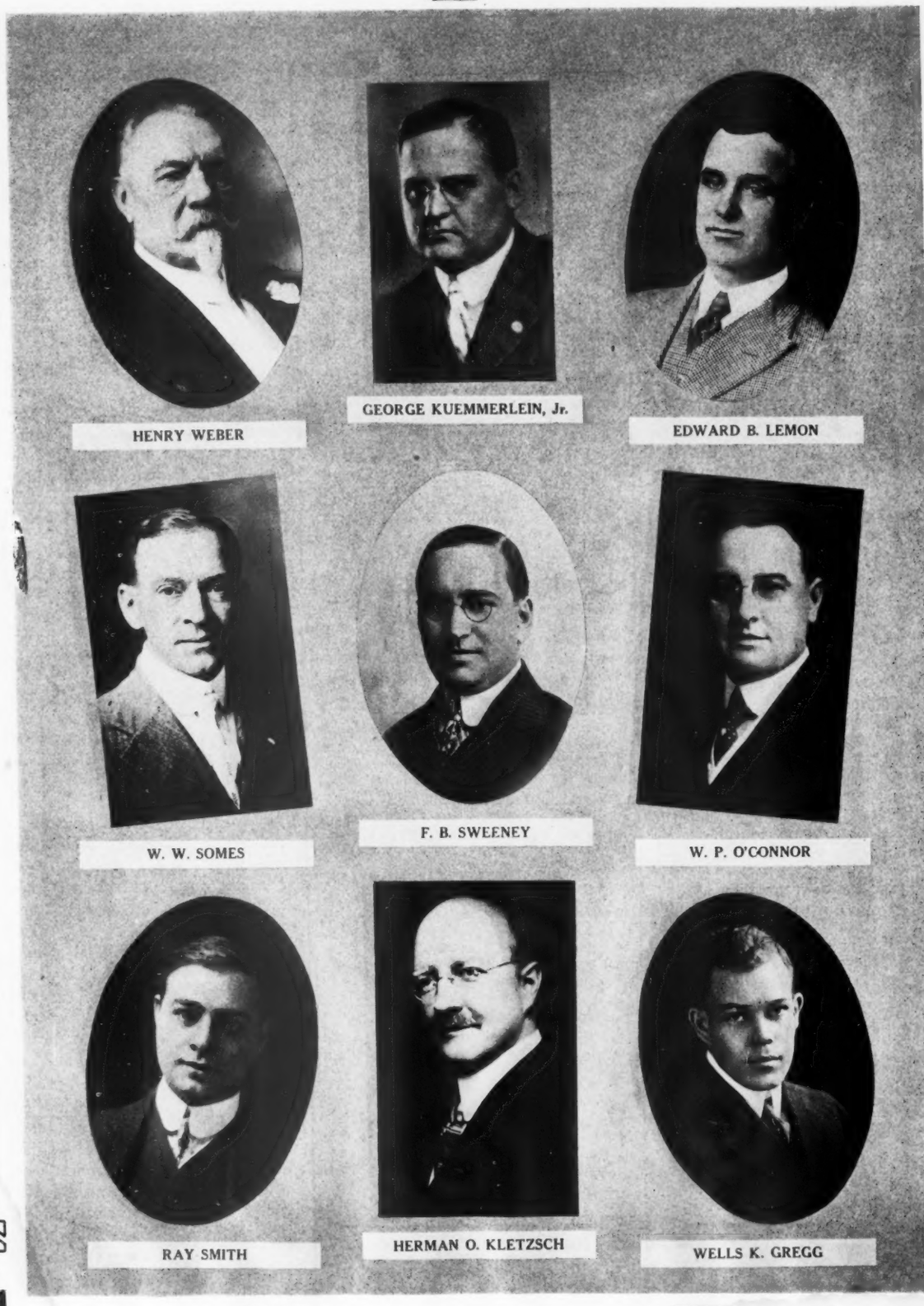
1:30 P. M.—Guests assemble at the Milwaukee Auditorium for plant visitation.

Mr. Levalley, who was at that time about 60 years of age, entered upon an entirely new line of endeavor, selecting a field in which this company was practically a pioneer. Soon after, W. C. Frye, destined to aid substantially in the industrial expansion of Milwaukee, became associated with the company. In the beginning, four small concerns were housed in one building, practically the size of single floor of any one of their present office buildings. These four companies were the Chain Belt Co., Pawling & Harnischfeger, Nordberg Mfg. Co., and J. M. Nash Co. The first named is at present a large manufacturer of conveying machinery, special traveling water screens for industrial plant intakes, concrete mixers and conveying auxiliaries. Pawling & Harnischfeger have built up a large establishment for the manufacture of cranes, hoisting and conveying machinery and special machine tools. The Nordberg Mfg. Co. occupies a prominent place among designers and builders of steam and fuel oil engines; steam air and electric hoists and compressors. The J. M. Nash Co. has developed an extensive business in the manufacture of special wood-working machinery.

Men Behind the Expansion

The Chain Belt Co. in turn formed the starting point for several other industries. In 1909 F. L. Sivyer, W. C. Frye and Donald Fraser, the latter superintendent of the Chain Belt company, started the Sivyer Steel Casting Co. in a building rented from the Northwestern Malleable Iron Co. This company had for its object the manufacture of crucible steel castings and later was among the pioneer makers of electric steel. Following this a few years, W. C. Frye, C. R. Messinger, Donald Fraser and W. C. Sargent, all associated in the parent company, bought the West Allis Malleable Iron Co. and changed the name to the Federal Malleable Co. Since that time part of the same personnel has become identified with Charles Piez and Prentice Cooley in an electric steel company in Chicago.

The same faith which has been demonstrated in the constant growth of the industry in Milwaukee has resulted in many advances in foundry practice. New developments have found ready acceptance, and in many instances, Milwaukee has taken the lead. Here some of the earliest crucible steel foundries were established. In 1909 there were 10 of these plants in this city then conceded to be the center of the crucible steel casting industry. The annual production of these foundries was in excess of 30,000 tons. The furnaces used were known as the Milwaukee type. They used crude oil for fuel,



IN ADDITION TO THE FOUNDRY AND METAL WORKING TRADES, THE REPRESENTATIVES OF OTHER MILWAUKEE INDUSTRIES ARE AIDING THE COMMITTEE ON ARRANGEMENTS

the use of which was developed among Milwaukee foundries. Later producer or commercial gas was used for crucible furnaces, and finally came the converter, the open-hearth and eventually the electric furnace.

Interest today centers on semisteel. Following tardily the example of France and England, the government is contracting for millions of semi-steel shells. While Milwaukee cannot claim credit for the doctrine of semisteel, she has reared some of its most devoted prophets. Probably 40 or 50 years ago, a mixture of gray iron and steel was tried experimentally in England. But at least 35 years ago this metal mixture solved a perplexing problem for the foundry foreman of the old Chicago, Milwaukee & St. Paul railroad shops. Elijah Fairbairn was the man in question. An important part of the equipment of the car shop was a bulldozer used to shape the diamond bars for car trucks. These bars were formed hot between dies. Two strokes were required on each bar, and two bars were required for each side of each truck. Consequently, the bulldozer was in constant operation to supply the needed output. It was found that the dies were short-lived. Cast iron lasted only about 48 hours in this service and steel dies were even less durable. As the operation was performed on bars heated cherry red, carbon steel dies quickly developed surface cracks. In his perplexity, Elijah Fairbairn conceived the idea of semisteel, though he would not have recognized his cupola mixture by that name and modern authorities on that alloy might question the accuracy of the term. He melted some cast scrap and steel chips from locomotive tires separately, and mixed the molten metals in a ladle. From this mixture he poured a pair of dies which came from the molds in flawless condition and were at once put in service.

During the next week, routine matters engaged the foreman's time, but every day he found opportunity to inspect the dies in the bulldozer. The following week and that which succeeded, found no deterioration in the castings. They kept their contour and showed no signs of surface cracks or abrasions. The longevity of the dies became a matter of common shop interest and they were closely watched until discarded at the end of three months' continuous service. Mr. Fairbairn endeavored to duplicate the

Milwaukee Convention Committees

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Theodore O. Vilter, chairman, Vilter Mfg. Co.
A. E. Harrison, Allis-Chalmers Mfg. Co.
E. W. Bearman, Illinois Steel Co.
John D. Bird, Power & Mining Machinery Co.
James L. Marshall, George A. Smith Steel Casting Co.
W. G. Bruce, Milwaukee Association of Commerce
Henry Weber, Milwaukee park board.
George Kuemmerlein, Milwaukee Electric Railway & Light Co.
A. E. Copeland, Hotel Wisconsin.
W. P. O'Connor, Goodrich Transportation Co.
F. C. Reynolds, Pere Marquette railroad.
Joseph C. Grieb, Milwaukee Auditorium.
W. J. Fairbairn, Milwaukee Metal Trades & Founders' Association.

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Henry R. Donald, H. R. Donald Sales Co.
T. A. Glasscot, Pickands, Brown & Co.
O. B. Pupikofer, American Gum Products Co.
W. J. Fairbairn, Milwaukee Metal Trades and Founders' Association.
Ray Smith, Pfister hotel.
A. E. Copeland, Hotel Wisconsin.
Herman Kletzsch, Republican house.
W. W. Somes, Hotel Carlton.
W. M. Nefzger, Hotel Schlitz.
S. Duffy, Hotel Plankinton.
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James L. Marshall, George H. Smith Steel Casting Co.
H. R. Donald, H. R. Donald Sales Co.
Wells K. Gregg, Sivyer Steel Casting Co.
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James L. Marshall, chairman, George H. Smith Steel Casting Co.
J. J. McDevitt, S. Obermayer Co.

Ladies' Committee

A. E. Copeland, chairman, Hotel Wisconsin.
F. C. Reynolds, Pere Marquette railroad.
Henry Weber, Milwaukee park board.
O. B. Pupikofer, American Gum Products Co.

Women Members of Ladies' Committee

Mrs. J. H. Pinson, chairman.
Mrs. A. E. Copeland.
Mrs. Reinhold Koepsell.
Mrs. John Koepsell.
Mrs. H. W. Wehr.
Mrs. T. H. Cochrane.
Mrs. Theodore O. Vilter.
Mrs. C. R. Messinger.
Mrs. J. D. Bird.
Mrs. T. A. Glasscot.
Mrs. John Thomas.
Mrs. A. J. Lindeman.
Mrs. Otto H. Falk.
Mrs. Walter Kasten.
Mrs. George Kuemmerlein.
Mrs. W. P. O'Connor.
Mrs. Frank H. Weber.
Mrs. F. C. Reynolds.
Mrs. E. W. Bearman.
Mrs. E. A. Wruster.
Mrs. W. J. Fairbairn.
Mrs. W. G. Bruce.
Mrs. Joseph C. Grieb.
Mrs. Arthur E. Gross.
Miss Margaret Bloodgood.
Mrs. Ray Smith.
Mrs. Ernst Clarenbach.
Mrs. Harry S. Hadfield.

A COMPREHENSIVE PROGRAM HAS BEEN PROVIDED BY THE LADIES' ENTERTAINMENT COMMITTEE AND REPRESENTATIVES OF MILWAUKEE'S CIVIC BODIES HAVE SHOWN A GREAT INTEREST IN THE METALS CONGRESS

conditions which had produced these castings, but although similar materials were used, the record of the first pair was never equaled. A mixture of steel and cast iron continued to be used, but the ideal was not attained again.

It was not until many years later that what is properly called semisteel was produced successfully and continuously. This again was in Milwaukee at the foundry of A. Christensen, now the National Brake & Electric Co. At this plant, the modern method of using a large percentage of steel with cast iron to produce castings of light section was first developed. And the prophet of the doctrine of semisteel, who is well known to the whole foundry industry, is David McLain, then with the A. Christensen foundry.

Necessity Brings Molding Machine

The Prairie du Chein shops of the St. Paul railroad, which were presided over by Elijah Fairbairn, have another claim to pioneer foundry honors. In the early '80s attention was not so sharply directed to quantity production. Labor, which after all is the sharp stick behind increased output, was plentiful and cheap. Greater deliberation prevailed in all lines and more especially in railroading. Nevertheless, the volume of production expected from this railroad foundry increased steadily, and some departments were scrutinized to find means for meeting the demand. Car brasses were needed in greater quantities, and even a cursory examination showed that the molding operation was the factor underlying the delay. Accordingly, an improved stripping-plate molding machine was devised which speeded up the entire chain of production. This was in 1884, and probably this machine was one of the first examples of this now common form of foundry equipment.

Steel casting has shown remarkable progress in Milwaukee. With the increasing cost of oil fuel, crucible steel casting encountered difficulties. This city was not slow to appreciate the condition and some of her larger foundries at once installed converters which were used in conjunction with cupolas. Others developed open-hearth facilities to meet the need for steel and electric furnace practice, in turn, was accepted practically in its incipient stage. With the more general adoption of this latter type of steel-making unit, Milwaukee has gone rapidly forward until at present there are six foundries with seven electric furnaces in Milwaukee.

The country at large did not take stock of the foundry industry of the Wisconsin metropolis until about 1892. At that time there were 18 gray iron foundries in Milwaukee with an output of about 80,000 tons per year. Most of this was utilized within the city in the manufacture of machinery, engines, cars, etc. There were two malleable plants at this time with a capacity of about 15,000 tons a year. Mitis iron, an alloy produced by dead melting gray iron with a small percentage of aluminum, was made in small quantities by these malleable foundries.

It was only a few years later when recognition was accorded Milwaukee as the leading steel foundry center. In 1907 the Falk Steel Casting Co. was said to be the largest of its kind in the country, with the George H. Smith Steel Casting Co. second and other Milwaukee steel foundries well up on the list. The Falk Steel Casting Co. was established in 1900 as an oil-fired converter plant. Later three 15-ton, an 18-ton and a 25-ton open-hearth furnace and a complete producer gas plant were installed. The present capacity is over 2000 tons of steel castings per month. The history of the company identified with the policy of advancing men from within the organization. Every man in an executive position at the present time has worked up through the foundry. The foundry at present is engaged 100 per cent on war work This includes special castings for the navy, gun mounts, car castings, gears, car sundries, and tractor parts. The gear department handling large turbine reduction gears, and special large castings is especially well organized and efficient.

The George H. Smith Steel Casting Co. started as a crucible foundry. In 1898, faced by an increase in fuel costs and limitations of output, the company installed a converter. Later other converters were added until at present the melting equipment includes three 2-ton converters, and a 4½-ton open-hearth furnace. The floor area, exclusive of office space and pattern storage has increased from 9000 square feet in 1898 to 45,000 square feet at the present time. The present output is in excess of 750 tons per month and is for direct or indirect war purposes.

Milwaukee's Foundry Growth

The recent years have marked a steady advancement of production in all metalworking lines. The first banner year was 1906, and the blow of the 1907 financial stringency was parried by the first 10 months production which excelled all previous records. From this time until 1913 a steady growth was apparent and foreign trade assumed an important role. With the outbreak of the war a slight shrinkage was felt, but with the readjustment following the government's mammoth requirements, production jumped 50 per cent in 1915-16. Milwaukee found her place in the world war and filled it with credit. The increases since 1916 have been remarkable. In 1917 alone the value of metal products produced by the city's manufacturers jumped from $61,633,613 to $107,802,063. The manpower engaged in this production during this period increased from 22,244 to 26,082. This discrepancy between the increase in number employed and the value of the product is explained by the intensive production methods developed and the energy displayed in all Milwaukee plants at the present time.

The increase in foundry facilities during the interval from 1916 to the present time has been remarkable. There are at present 94 foundries in the city, while in 1916 there were but 69. This growth can be assigned to no factor other than the demand induced by war conditions and fostered by the city's extensive machinery manufacturies.

Pittsburgh Foundrymen Appoint Committees

At the monthly meeting of the Pittsburgh Foundrymen's association, held at the American Republican club, Sept. 16, Commodore R. G. Denig, inspector of engineering materials for the United States navy, gave an interesting talk on "Castings." Maj. Joseph T. Speer, president of the Pittsburgh Valve Foundry & Construction Co., was elected an honorary member. The appointment of the following committees was announced:

Program:—C. F. Williams, Allen S. Davison Co., chairman; Edward Frohman, S. Obermayer Co.; William R. McCord, W. H. Stanton, National Iron & Steel Publishing Co. and A. M. Andresen, the Knox-Andresen Co.

Entertainment:—J. S. McCormick, J. S. McCormick Co., chairman; W. W. Sanderson, Carborundum Co.; C. W. Howat, Union Steel Casting Co.; T. J. Malone, J. S. McCormick Co. and F. J. Page, Whiting Foundry Equipment Co.

Foremen:—S. L. Mott, Duquesne Steel Foundry Co., chairman; Robert Schweppe, Mesta Machine Co.; Gustave A. Bauman, Jones & Laughlin Steel Co.; Fred Lippold, United Engineering & Foundry Co. and John Field, Union Steel Casting Co.

Membership:—E. J. Koch, Fort Pitt Steel Casting Co., chairman; Samuel H. Jasper, Penton Publishing Co.; L. A. Way, Lewis Foundry & Machine Co.; George Kern, Duquesne Steel Foundry Co. and Henry Spilker, Sterritt-Thomas Foundry Co.

What You Will See at the Milwaukee Exhibition

Labor-Saving Equipment to be Displayed and Demonstrated—Will Show Manufacturers in the Metal-Working Industries How to Save Manpower

ABELL-HOWE CO., Chicago—This company will exhibit trucks arranged for hand trucking and also equipped as trailers for trucking with power tractors. The operation of this truck in a foundry will be displayed by moving pictures and photographs. This exhibit also will include an electric hoist with foundry control as well as other equipment marketed by this company; represented by O. J. Abell, R. E. Stuntz and J. O. Humbert.

ABRASIVE CO., Philadelphia—Abrasive wheels manufactured by this company for grinding cast iron, brass, bronze and all metals of low tensile strength will be exhibited. Also, boro-carbone wheels will be displayed which are used principally for grinding steel; represented by Clyde W. Blakeslee, Herbert A. Loomis, George J. Bassler and F. B. Miller.

ACME MACHINE TOOL CO., Cincinnati—A universal flat turret lathe will be shown in operation; represented by Fred Winkelman, J. R. Pearson and A. J. Jones.

AIR REDUCTION SALES CO., New York.—Oxy-acetylene and cutting apparatus, oxy-acetylene generatorsand oxygen and acetylene compressed in cylinders will be displayed. Practical demonstrations of this equipment also will be made; represented by L. H. Atkinson, E. L. Mills, R. T. Peabody, E. M. Sexton and R. A. Sossong.

ALLIS-CHALMERS MFG. CO., Milwaukee.—Power plant equipment.

AMERICAN FOUNDRY EQUIPMENT CO., New York—A sand cutting machine built by the Sand Mixing Machine Co. will be shown as well as a rotary table sand blast room of the humane type equipped with a table 9 feet in diameter and a new type rotary table sand blast cabinet. This exhibit will be made jointly with the Sand Mixing Machine Co., New York; represented by V. E. Minich, H. L. Wadsworth, Hutton H. Haley and John D. Alexander.

AMERICAN GUM PRODUCTS CO., New York—Cores made with the binder manufactured by this company will be exhibited and castings produced by the use of these cores also will be shown; represented by Gordon I. Lindsay, W. E. Baird, O. B. Parker, A. J. Kies, M. F. Coughlin.

AMERICAN KRON SCALE CO., New York—The automatic, springless dial scale built by this company will be shown and an attachment will be displayed which may be hooked onto beam scales thereby converting them into automatic scales without discarding the beam scale equipment; represented by E. Ohnell, C. F. Larson, E. M. Abramson, J. Kirk Rowell, Sykes & Kraber.

AMERICAN MOLDING MACHINE CO., Terre Haute, Ind.—The space of this company will be fitted up as an office and reception room; represented by W. C. Norcross and Louis J. Cox.

ARCADE MFG. CO., Freeport, Ill.—The molding machine exhibit to be made by this company will be operated and will include the Modern machine equipped with a plate for special work, air squeezers, combined jolter and squeezer, pouring device, plain jolting machines and a display of brass and iron castings of intricate design produced on these machines; represented by Henry Tscherning, August Christen, G. D. Wolfley, Mentor Wheat and R. E. Turnbull.

ARCWELL CORP., New York.

ARROW FORGING & TOOL WORKS, Chicago—All kinds of chipping tools for use in foundry cleaning rooms will be shown; represented by L. G. Groessl and Alvin F. Kunz.

ASBURY GRAPHITE MILLS, Asbury, N. J.—The extensive line of graphite products manufactured by this company will be shown, including foundry facings, boiler graphite, graphite for crucibles, etc.; represented by H. M. Riddle, Jr.

ATKINS, E. C. & CO., Indianapolis—This exhibit will consist of motor-driven metal cutting machines, metal cutting saws, hack saw blades, pattern plates, etc.; represented by T. A. Carroll, T. H. Endicott, G. W. Steenbergh and Lewis Okey.

AUSTIN CO., Cleveland—A pictorial display will be made of this company's method of 30-day building construction. A model of a standard building will be exhibited, as well as samples of essential materials used. A series of photographs illustrating the Austin standard buildings for foundries and machine shops also will be shown; represented by G. A. Bryant, W. L. Bailey, W. F. Chambers, G. A. Dodge and W. L. Towne.

BADGER-PACKARD MACHINERY CO., Milwaukee—The extensive line of iron and woodworking machinery, transmission meters and machinists' supplies, as well as electrical equipment handled by this company will be displayed. This will include a universal woodworker built by the Sidney Machine Tool Co., Sidney, O.; turret lathe, built by the W. K. Millholland Machine Co., Indianapolis; shaper, by John Steptoe Co., Cincinnati; tool and cutter grinder by Oesterlein Machine Co., Cincinnati; five-spindle automatic drilling and vertical drilling machines, by the Detroit Tool Co., Detroit; motor-driven, geared head lathe, by the Monarch Machine Tool Co., Sidney, O.; electric grinding tools, by the Wisconsin Electrical Co., Racine, Wis.; electric glue heating apparatus, by the International Electric Co., Indianapolis; and motors, by the Lincoln Electric Co., Cleveland; represented by C. A. Schuman, W. D. Romaine, Paul Sladky, H. S. Molony and E. G. White.

BARRETT CO., Chicago—This space will be fitted up as a reception and rest room; represented by H. M. Wilson and H. R. Hansen.

BASTIAN-BLESSING CO., Chicago—A complete line of welding and cutting apparatus will be exhibited. Attention will be directed to recent improvements in welding and cutting equipment whereby the flash-back has been eliminated; represented by L. G. Blessing, M. Keith Dunham, F. W. Munson.

BATTLE CREEK SAND SIFTER CO., Battle Creek, Mich.—Air-driven, as well as hand and belt-driven sand sifters will be shown. These will be equipped with 16x28-inch screens of the no-sag type. Sprayers for blacking cores and molds, as well as safety deposit boxes also will be exhibited; represented by R. R. Wilder.

BERKSHIRE MFG. CO., Cleveland—The extensive line of molding machines to be shown by this company will be operated and will include an air squeezer equipped with a split pattern plate, air squeezer equipped with stripping plate, air squeezer equipped with match plate with special device for closing the mold on the machine without removing the cope, and an air squeezer equipped with an aluminum match plate. Molding machine accessories such as vibrators, knee valves, blow-off valves, etc., also will be displayed; represented by W. D. Fraser and G. L. Cannon.

BIRKENSTEIN, S. & SONS, Chicago—The extensive line of nonferrous metals in ingoot form produced for the brass foundry trade by this company will be displayed, including ingot brass, ingot bronze, pig copper, aluminum, manganese bronze, pig tin, pig lead, solder, babbitt, phosphor-copper and phosphor-tin. In addition, castings from these products also will be shown; represented by H. Birkenstein, C. Raphael, M. Isaacson, N. Slohm, H. Goldstine, M. Schero and S. Pflaum.

BLODGETT, G. S. Co., Burlington, Vt.—Two types of portable core ovens will be exhibited which are intended for testing and experimental purposes, but which also may be used for baking small cores, for annealing, japanning, hardening and drying; represented by R. L. Patrick.

BLYSTONE MFG. CO., Cambridge Springs, Pa.—A 7-cubic foot, motor-driven core sand mixer, equipped with a revolving screen will be shown in operation; represented by L. G. Conroe and A. W. Ferguson.

BRISTOL MACHINE TOOL CO., Bristol, Conn.—The equipment manufactured by this company will be exhibited by the Federal Machinery Sales Co., Chicago.

BROWN SPECIALTY MACHINERY CO., Chicago—Three styles of machines for making cores, 3¾ to 7 inches in diameter, will be shown, as well as an 84-inch rotary table sand-blast machine and a pneumatic charging truck for malleable iron annealing ovens; represented by Elmer A. Rich, Jr., J. E. Sweet, H. T. Rich, John Laycock and Robert L. Laycock.

BUCKEYE PRODUCTS CO., Cincinnati—Both crucible and noncrucible melting furnaces which may be operated with different fuels, will be exhibited together with oil and gas burners, compressed air and electric vibrators, parting compounds, high temperature furnace cement, metal fluxes, core compounds and core oils, snap flask guides, mold driers, annealing and core drying ovens, crucible hold back device and a general line of foundry supplies; represented by C. J. Goehringer, R. B. Ferguson, B. Bernbaum, C. Gysin and E. L. Bunting.

CARBORUNDUM CO., Niagara Falls, N. Y.—An extensive display will be made of abrasive wheels and abrasive materials for use by the foundry trade, including grains, discs, abrasive cloth and granite paper for pattern shop use; represented by Anthony Dobson, Edw. Edwards, J. M. Engman, Benjamin Leve, R. C. Bradbury, H. E. Kerwin and W. E. Knott.

CAULKINS-CARPENTER CO., Chicago—The adjustable, semi-automatic jig built by this company, which permits of performing drilling operations without interruption or loss of time on account of loading or unloading the jig, will be shown. In addition, a sensitive drilling, tapping and boring machine and a portable electric shop fixture will be displayed; represented by C. Y. Carpenter.

CENTRAL ELECTRIC CO., Chicago—Industrial lighting units and heavy duty plugs and receptacles for electrical work will be exhibited; represented by G. M. Cox.

CHAMPION FOUNDRY & MACHINE CO., Chicago.—An electrically-driven sand riddle and a jolt-ramming roll over power draw molding machine for making cores and molds will be shown in operation; represented by T. J. Magnuson, H. O. Magnuson and Anton Magnuson.

CHASE, FRANK D., INC., Chicago.—Enlarged photographs of plants built by this company will be displayed.

CINCINNATI PULLEY MACHINERY CO., Cincinnati—A complete line of different sizes of ball-bearing drilling machines as well as a high duty pulley lathe will be exhibited; represented by J. G. Hey, C. K. Cairns, J. F. Mirrielees and D. A. Patterson.

CLARK, CHARLES J., Chicago—Blast volume meters of various types and capacities for application to cupolas and malleable furnaces will be exhibited. One meter will be connected to a blower to demonstrate its method of operation. A special type of mercury pressure gage for foundry use also will be shown; represented by Charles J. Clark and Frederick G. Klee.

CLEVELAND OSBORN MFG. CO., Cleveland, O.—

Practically all of the various types of molding machines manufactured by this company will be shown in operation and will include a direct-draw roll over machine, jolt stripping plate machine, combination jolt stripping squeezer, combination jolt squeezer, plain air squeezer, plain jarring machine and roll over machine and a hand operated stripping plate machine; represented by H. R. Atwater, E. S. Carman, J. C. Alberts, E. J. Byerlein, E. T. Doddridge, H. E. Deakins, E. Q. Jacobi and F. T. Spikerman.

CLEVELAND PNEUMATIC TOOL CO., Cleveland, O.—An elaborate display will be made of the complete line of air tools manufactured by this company consisting of air drills in all sizes, sand rammers, core breakers, chipping hammers, riveting hammers, emery grinders, valve grinders, air hose coupling, air valves, fittings, hose clamps and air hose; represented by H. S. Covey, Arthur Scott, C. D. Garner, H. C. Newton, Captain F. H. Burr, F. E. Schwarze and Guy Gregory.

CLIPPER BELT LACER CO., Grand Rapids, Mich.—Belt lacer machines, belt hooks and pins and photographs illustrating various uses of belt lacing and its adaptability to various conditions, as well as sample joints, will be displayed; represented by Paul P. Rohns and P. E. Crothers.

COALE, THOMAS E., LUMBER CO., Philadelphia—An unsually interesting display of Michigan white pine and genuine Madera California sugar pine pattern lumber will be made; represented by Thomas E. Coale, A. W. Anderson and E. C. Anderson.

COMBINED SUPPLY & EQUIPMENT CO., Buffalo—Angle stem chaplets will be exhibited; represented by S. LeViness, Jr., and C. L. Jackson.

CORN PRODUCTS REFINING CO., New York—Cores made with core binders manufactured by this company will be produced and baked in an oven constituting a part of this company's exhibit. A liquid core binder also will be shown. An interesting and valuable booklet on coremaking written by Richard Mildenke, which contains new and important facts relating to coremaking will be distributed; represented by Dr. W. R. Cathcart, F. G. Faller, Jr., H. S. Karch, D. T. McGrory, J. A. Oates.

DAILY IRON TRADE AND METAL MARKET REPORT, Cleveland—This booth will be fitted up as a rest room for visitors where all are invited to make their headquarters; represnted by John A. Penton, A. O. Backert, J. D. Pease, H. Cole Estep, Charles J. Stark, R. V. Sawhill, V. G. Iden, George H. Manlove, H. S. Jasper, G. O. Hayes, A. L. Klingeman, F. V. Cole, L. C. Pelott and D. M. Avey.

DAVENPORT MACHINE & FOUNDRY CO., Davenport, Ia.—The extensive line of molding machines manufactured by this company will be exhibited; represented by Edward Whitaker, A. D. Ziebarth, A. V. Magnuson and Carl Falk.

DAVIS-BOURNONVILLE CO., Chicago—The equipment to be displayed by this company will be shown in operation. This will reflect the great advances made in the use of machinery for oxy-acetylene cutting and welding. These machines will include an oxygraph which will occupy a space, 8x16 feet; another machine of this type which makes one cut only and which will occupy a space 8x7 feet, and a radiagraph will be exhibited adapted for both light and heavy cutting of steel up to 36 inches in thickness. This machine will occupy a space of 6x4 feet. The magnetograph to be shown is designed for cutting circles in steel plates. A duplex oxygen manifold for making oxygen tanks also will be exhibited. A cabinet truck which will accommodate acetylene and oxygen tanks and which contains a welding unit with two sizes of torches as well as a cutting unit, will also be shown; in addition, there will be displayed a pressure generator, a complete line of torches, regulators and tips; represented by R. O. Mueller, C. F. Williams, A. C. Collins, J. R. Wilson, Fred Maeurer, H. Bird and W. P. Noxon.

DAYTON MOLDING MACHINE CO., Dayton, O.—The molding machines to be displayed by this company will be shown in opeation and will include a 28-inch jolt rock over draw machine with a 12-inch draw, 12-inch jolt squeezers and 16x16-inch jolt squeeze pattern machines; represented by T. J. Mumford II, H. W. Sinclair, J. A. Walsh and G. W. Smith.

DEISTER CONCENTRATOR CO., Ft. Wayne, Ind.—This exhibit will consist of a laboratory size Deister-Overstrom diagonal deck table which will be operated, but no material will be run over it. However, samples of material that have been treated on these tables will be displayed. This table is designed for the treatment of foundry residue. In addition to this exhibit, the Dings Magnetic Separator Co., Milwaukee, will place one of its magnetic separators in this booth in order to show the close relationship of the two machines in the handling of residue; represented by E. J. O'Connell and B. J. Roberts.

DINGS MAGNETIC SEPARATOR CO., Milwaukee—Various types of the magnetic separators built by this company will be shown in operation. These will include a machine with a motor generator set, another separator with a motor and a large diameter magnetic pulley which will demonstrate the magnetic strength of one of these units. In addition, a separator adapted for use in smelting and refining works also will be shown. The separator equipped with a motor is used in gray iron, steel and malleable foundries for removing the iron ordinarily wasted in the dump. The machine equipped with a motor generator set is used in brass and aluminum foundries as well as in smelting and refining works and is particularly adapted for handling borings and turnings. A magnetic separator made by this company also will be installed in the booth of the Deister Concentrator Co. to demonstrate its application to the separation of the concentrates from their table which consists of both ferrous and nonferrous metals. In addition to this exhibit in Machinery Hall, space has been reserved in the Arena which will be used as a reception room and in which also will be displayed a small magnetic separator; represented by R. A. Manegold, E. S. Hirschberg, G. H. Fobian, R. Kretchmar.

DIXON, JOSEPH, CRUCIBLE CO., Jersey City, N. J.—A general line of graphite products will be shown including crucibles, stoppers, nozzles, sleeves, stirrers, etc. An unusually complete display of automobile lubricants will be made as well as motor brushes, graphite paint, etc.; represented by H. C. Sorenson, F. R. Brandon, W. B. Allen, D. A. Johnson, A. L. Haasis and George Neighbor.

ELLIS, R. E., ENGINEERING CO., Chicago—An extensive line of metal-working equipment will be exhibited by this company, including air-operated chucks and equipment, automatic die heads and taps, production reamers and boring bars, adjustable reamers and drill chucks, oil and gas-burning furnaces, auxiliary multiple spindle drill heads, deep hole drilling machines, hydraulic presses, etc.; represented by R. E. Ellis, Fred Fisher, F. Alexander Roger, R. A. Braunberger and C. D. Gordon.

ERWIN MFG. CO., Milwaukee—Fire extinguishers of various sizes of both copper and steel construction will be exhibited as well as portable engines for extinguishing fires; represented by J. G. Erwin.

FEDERAL FOUNDRY SUPPLY CO., Cleveland—An extensive display will be made of molding machines, snap flasks, slip jackets, chaplets, etc.; represented by W. J. Adams, Ralph Ditty, John Bayer, W. J. Smith, E. Kaye, George A. Fuller, T. H. Terry and F. L. Ditty.

FEDERAL MACHINERY SALES CO., Chicago—An extensive display of machine tools will be made which will be shown in operation. These will include a 20-inch x 10-foot motor-driven Greaves-Klusman, quick-change gear engine table; a Gooley & Edlund motor-driven milling machine; several Henry & Wright high speed ball bearing drills; a Bristol Motor-driven ring grinder; two Bristol hand milling machines, belt-driven; Oakley universal cutter and tool grinder and a Southworth screw machine; represented by James L. Gough, H. L. Cole.

FOREIGN CRUCIBLE CORP., New York—Samples of French graphite, crucibles will be exhibited; represented by George H. Ames.

FREEMAN MFG. CO., Racine, Wis.—Molding machines.

FOUNDRY, THE, Cleveland—This booth will be fitted up as a rest room for the visitors where all are invited to make their headquarters; represented by John A. Penton, A. O. Backert, J. D. Pease, H. Cole Estep, Charles J. Stark, R. V. Sawhill, V. G. Iden, George H. Manlove, S. H. Jasper, G. O. Hays, A. L. Klingeman, L. C. Pelott and D. M. Avey.

FOUNDRY APPLIANCE CO., Newark, N. J.—A device for handling the cope for drawing patterns on power squeezers will be displayed; represented by J. N. Frantz and D. B. Diss.

FOUNDRY EQUIPMENT CO., Cleveland—No equipment will be shown by this company, but a large number of enlarged photographs will be displayed of installations of core and mold ovens, core and mold cars, aluminum and brass melting furnaces, etc.; represented by F. A. Coleman and C. A. Barnett.

FOUNDRYMEN'S SUPPLY CO., Milwaukee—The molding machines manufactured by this company will be shown in operation. In addition, this exhibit will include a display of vibrators and samples of different grades of mold and core sand, fire clay and silica wash; represented by Mr. Holland.

GARDEN CITY SAND CO., Chicago.—Samples of molding sands, fire brick furnace sands, fire clay, etc., will be exhibited; represented by William Chambers.

GENERAL ELECTRIC CO., Schenectady, N. Y.—Enlarged photographs will be displayed showing General Electric apparatus and lantern slides will be projected to illustrate the foundry applications of these products; represented by L. W. Shugg.

GENERAL STEEL CO., Milwaukee—Steel billets, steel bars and other steel products manufactured by this company will be shown and photographs illustrating this company's mill and equipment also will be displayed; represented by R. C. Gosrow, W. E. Moore, E. Gruhl and F. E. Patton.

GORDON SAND CO., Conneaut, O.—This booth, which essentially will be fitted up as a rest room, also will contain a display of the samples of the extensive line of molding sand mined by this company for the production of aluminum, brass, gray and malleable iron castings; represented by F. E. Gordon, Warner R. Thompson, W. E. Thompson and Taylor H. Boggis.

GREAT WESTERN MFG. CO., Leavenworth, Kans.—Three types of gyratory foundry riddles manufactured by this company will be shown in operation; represented by George W. Combs and F. A. Pickett.

GREAVES-KLUSMAN TOOL CO., Cincinnati—The display of machine tools to be made by this company will be shown in the space of the Federal Machinery Sales Co., Chicago. It will consist of a 20-inch x 10-foot all-geared head lathe of the single lever control type, which provides 10 speeds with one lever and also permits of starting, stopping and reversing the machine.

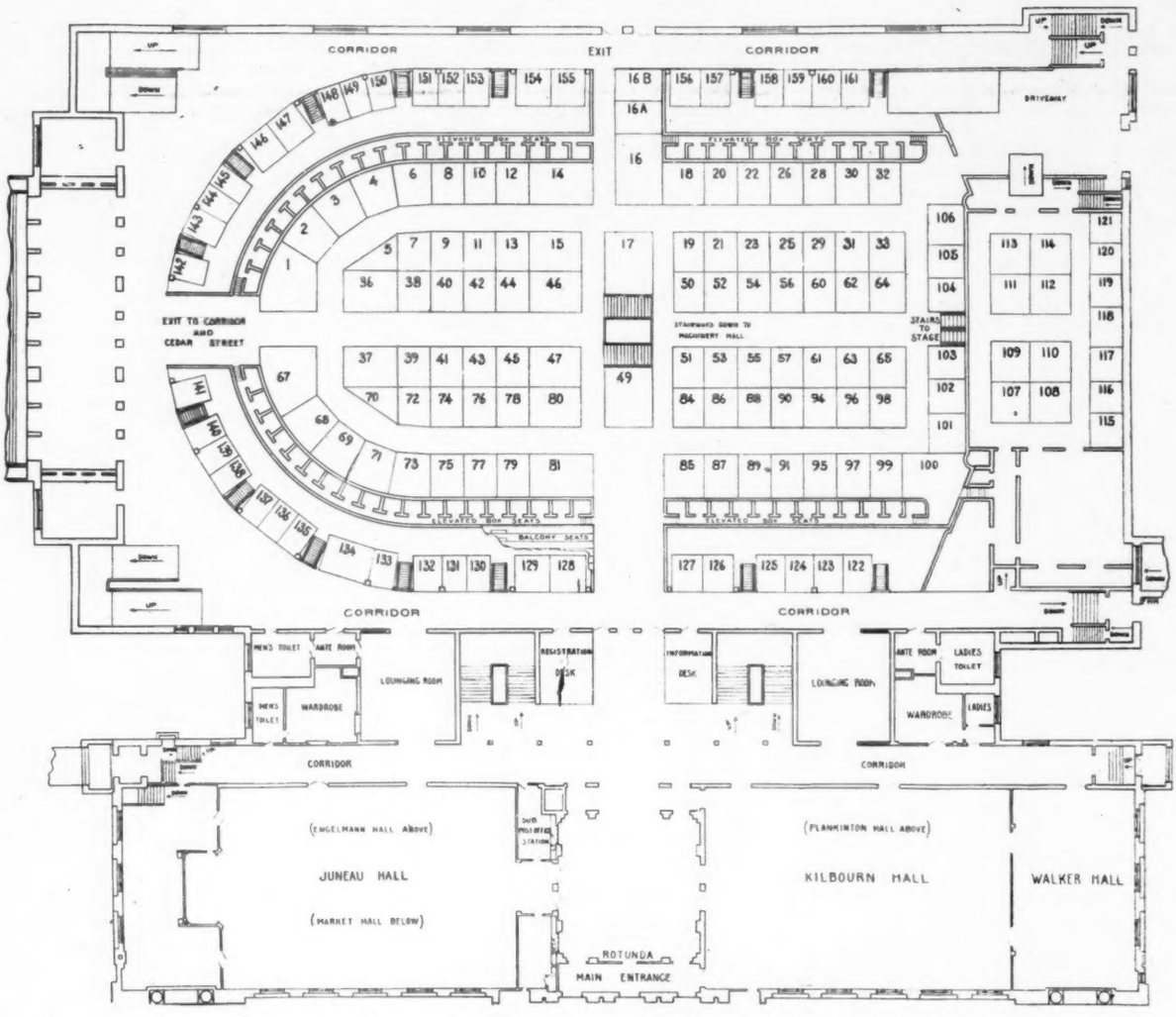
GRIMES MOLDING MACHINE CO., Detroit—The molding machine exhibit to be made by this company will be shown in operation and will include a jar-ramming roll over molding machine, hand-ramming roll over molding machine and a small coremaking machine; represented by George L. Grimes, Charles J. Skeffington and L. V. Grimes.

HAUCK MFG. CO., Brooklyn, N. Y.—Oil-burning outfits for lighting cupolas, ladle heaters, mold driers, preheating torches for welding operations, kerosene torches and furnaces, oil fuel furnace burners, rivet sets and annealing furnaces will be shown; represented by A. Busch Hauck, Willis C. Squire and H. E. Giersche.

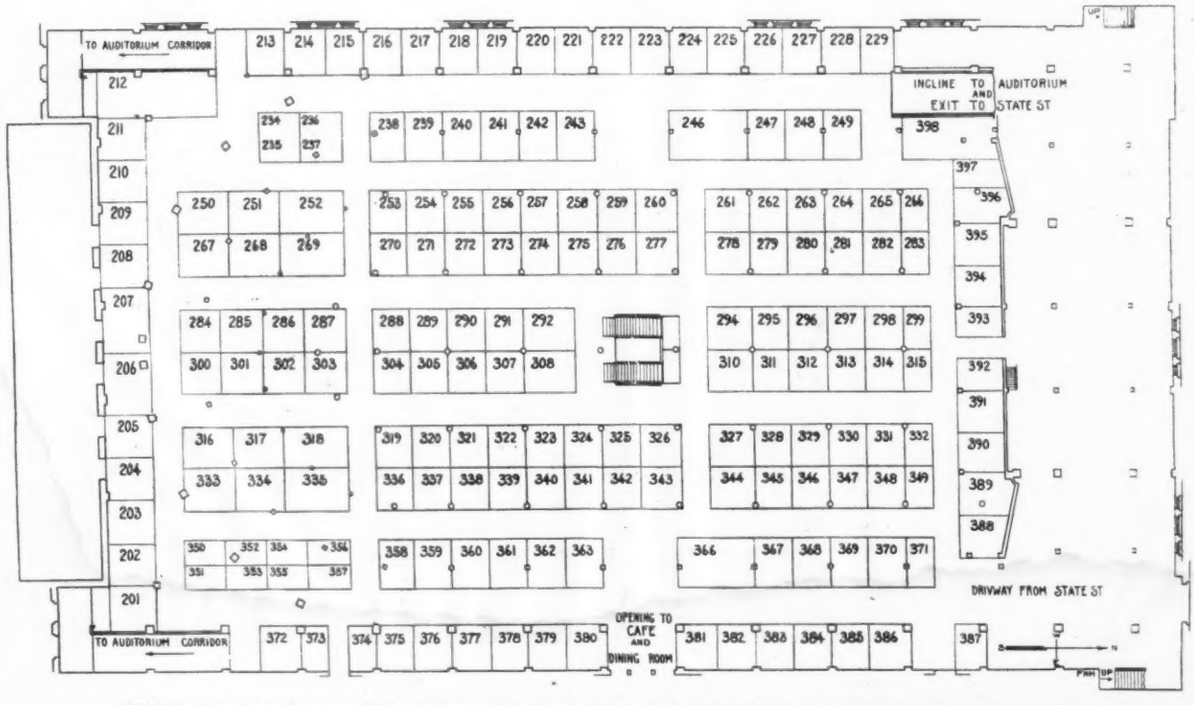
HAUSFELD CO., Harrison, O.—An open flame, noncrucible furnace; crucible tilting furnace and an aluminum furnace will be exhibited. These are adapted for operation with natural or artificial gas, or fuel oil. Other parts of this display will include vibrators as well as samples of a highly refractory cement made by this company; represented by J. S. Annom, Joseph E. Hausfeld and C. E. Haddock.

HAYNES STELLITE CO., Kokomo, Ind.—Several grades and styles of arc-welded and butt-welded bits, milling cutters, end mills, etc., will be displayed. Also, dental and surgical and table cutlery, etc., will be shown. The latter exhibit will be made for demonstrating the possibilities of stellitic in this line of manufacture; represented by P. P. Hale and E. H. Lucker.

HAYWARD CO., New York—An exhibit will be made of working models of clamshell and orangepeel buckets and an electric motor bucket of this type also will be shown in operation. In addition to the



THE ARENA OF THE MILWAUKEE AUDITORIUM, WITH THE EXHIBITORS' BOOTHS NUMERICALLY INDICATED


TO AUDITORIUM CORRIDOR
INCLINE TO AND EXIT TO AUDITORIUM AND STATE ST
DRIVWAY FROM STATE ST
OPENING TO CAFE AND DINING ROOM
TO AUDITORIUM CORRIDOR

MACHINERY HALL OF THE MILWAUKEE AUDITORIUM WITH THE EXHIBITORS' BOOTHS NUMERICALLY INDICATED

Exhibitors In Arena

No. of Booth	Exhibitor
107-110	Allis-Chalmers Mfg. Co.
12-14	American Gum Products Co.
29	American Kron Scale Co.
16A	Arcwell Corp.
102	Asbury Graphite Mills.
106	Austin Co.
103	Barrett Co.
55	Birkenstein, S., & Sons.
73	Blodgett, G. S., Co., Inc.
61	Brass World Publishing Co.
75	Chase, Frank D., Inc.
100, 101	Coale, Thomas, E., Lumber Co.
26	Combined Supply & Equipment Co.
20, 22	Corn Products Refining Co.
51, 53	Dixon, Joseph, Crucible Co.
19, 21, 24, 50, 52, 54	*Daily Iron Trade and Metal Market Report.*
115	Erwin Mfg. Co.
94	Foreign Crucibles Corp.
19, 21, 23, 50, 52, 54	Foundry, The
79	Foundry Equipment Co.
56	Garden City Sand Co.
111-114	General Electric Co.
89, 91	General Steel Co.
105	Gordon Sand Co.
34	Hoevel Mfg. Co.
97	Holcomb Safety Garment Co.
37	Holland Core Oil Co.
95	Illinois Clay Products Co.
117	Industrial Electric Furnace Co.
45, 47, 78, 80	*Iron Age.*
19, 21, 23, 50, 52, 54	*Iron Trade Review, The*
98	Jennison-Wright Co.
96	Jurack, Chas., Pattern Works.
99	Kawin, Chas. C., Co.
6	Kellogg, Spencer & Sons.
77	Kelly, T. P., & Co., Inc.
63	King, Julius, Optical Co.
71	Laclede-Christy Clay Products Co.
119	Lane, H. M. Co.
16-B	Leeds & Northrup Co.
30	Loewenthal Co.
49	Lupton's, David, Sons Co.
81	McLain's System and McLain-Carter Furnace Co.
60	Maclean Publishing Co.
120, 121	Marden, Orth & Hastings Corp.
39	*Metal Industry.*
84, 86	Metal & Thermit Corp.
132	Mifflin Chemical Corp.
10	Monarch Engineering & Mfg. Co.
57	New Chicago Crucible Co.
135	New Era Mfg. Co.
11, 13, 15, 42, 44, 46	Obermayer, S., Co.
4	Pawling & Harnischfeger Co.
116	Peck Iron & Steel Works.
19, 21, 23, 50, 52, 54	Penton Publishing Co.
34	Pettinos, George F.
1, 2	Pickands, Brown & Co.
89, 91	Pittsburgh Furnace Co.
104	Portage Silica Co.
25	Progressive Metal & Refining Co.
85, 87	Quigley Furnace Specialties Co.
88, 90	Robeson Process Co.
17	Rogers, Brown & Co.
70	Shepard Electric Crane & Hoist Co.
118	Sheriffs Mfg. Co.
31, 33, 62, 64	Sly, W. W., Mfg. Co.
65	Smith, R. P., & Sons Co.
16	Smith, Werner G., Co.
8	Standard Optical Co.
67, 68	Sterling Wheelbarrow Co.
41	Stevens, Frederic B.
	Stodder, W. F.
43	Strong, Kennard & Nutt Co.
69	Swan & Finch Co.
28	United Compound Co.
76	United States Graphite Co.
18	United States Silica Co.
	Wangelin, Walter H., & Co.
32	Wheeler, F. H., Mfg. Co.
5, 7, 9, 36, 38, 40	Whiting Foundry Equipment. Co.

Exhibitors In Machinery Hall

No. of Booth	Exhibitor.
318	Abell-Howe Co.
290	Abrasive Co.
368	Acme Machine Tool Co.
387	Air Reduction Sales Co.
213-220	American Foundry Equipment Co.
	American Molding Machine Co.
253, 4, 5-270, 1, 2	Arcade Mfg. Co.
395	Arrow Forging & Tool Works.
381, 382	Atkins, E. C., & Co., Inc.
369, 370	Badger, Packard Machine Co.
385, 386	Bastian, Blessing Co.
396	Battle Creek Sand Sifter Co.
236, 237	Berkshire Mfg. Co.
291	Blystone Mfg. Co.
224-227	Brown Specialty Machinery Co.
263, 280	Buckeye Products Co.
308	Carborundum Co.
386	Caulkins-Carpenter Co.
206	Central Electric Co.
284	Champion Foundry & Machine Co.
342, 343, 341	Cincinnati Pulley Machinery Co.
315	Clark, C. J.
238-243	Cleveland Osborn Mfg. Co.
304, 305	Cleveland Pneumatic Tool Co.
307	Clipper Belt Lacer Co.
265, 266	Davenport Machine & Foundry Co.
378, 379, 380	Davis-Bournonville Co.
267, 268	Dayton Molding Machine Co.
230, 231	Deister Concentrator Co.
374, 375, 376	Dings Magnetic Separator Co.
362	Ellis, R. E. Engineering Co.
273, 274, 275	Federal Foundry Supply Co.
327, 8, 9-344, 5, 6	Federal Machinery Sales Co.
312	Foundry Appliance Co.
264	Foundrymen's Supply Co.
314	Freeman Mfg. Co.
337	Gibbons, James.
257, 258	Great Western Mfg. Co.
310, 311	Grimes Molding Machine Co.
300	Hauck Mfg. Co.
252	Hausfeld Co.
332	Haynes Stellite Co.
204, 205	Hayward Co.
286, 287	Herman Pneumatic Machine Co.
358	Hyatt Roller Bearing Co.
372	Imperial Brass Mfg. Co.
288, 289	International Molding Machine Co.
323, 324	Kearney & Trecker Co.
319, 320	Kempsmith Mfg. Co.
256	Locke Patterns Works
333, 334	Ludlum Electric Furnace Co.
316, 317	McCormick, J. S., Co.
363	McCrosky Reamer Co.
249	Macleod Co.
207	Magnetic Mfg. Co.
209	Mahr Mfg. Co.
351	Mail-o-meter Sales Co.
367	Marshall & Huschart Machinery Co.
285	Maxon-Premix Burner Co.
201	Milburn, Alexander, Co.
330	Modern Tool Co.
256	Monroe Calculating Machine Co.
292	Mumford Molding Machine Co.
340	Napier Saw Works.
246	National Engineering Co.
250	New Haven Sand Blast Co.
281, 282, 283	Nicholls, Wm. H., Co., Inc.
306	Norma Co. of America.
301, 302, 303	Norton Co.
321, 322, 338, 339	Oliver Machinery Co.
208, 221, 222, 223	Oxweld Acetylene Co.
210, 211, 212	Pangborn Corp.
336	Peerless Machine Co.
331	Phoenix Mfg. Co.
261, 262, 278, 279	Pridmore, Henry E., Inc.
347	Racine Tool & Machine Co.
390, 391, 392	Railway Mechanical Engineer.
	Republic Creosoting Co.
335	Richards-Wilcox Mfg. Co.
348, 349	Rivett Lathe & Grinder Co.
228, 229	Rothacker Film Mfg. Co.
213-220	Sand Mixing Machine Co.
373	Schroeter Engineering Co.
356, 357	Simonds Mfg. Co.
203	Standard Sand & Machine Co.
397, 398	Sullivan Machinery Co.
202	Syracuse Sander Mfg. Co.
247, 248	Tabor Mfg. Co.
361	Thomas Elevator Co.
388, 389	Torchweld Equipment Co.
259, 260, 276, 279	U. S. Molding Machine Co.
251	Wadsworth Core Machine & Equipment Co.
269	Wallace, J. P., & Co.
352	Wangelin, Walter H., & Co.
325, 326	Warner & Swasey Co.
353	Western Electric Co.
294, 299	Woodison, E. J., Co.
393, 391	Young Bros. Co.

foregoing equipment, a collection of photographs illustrating this company's machines in operation in foundries and other industries will be displayed; represented by C. F. Hutchings and H. M. Davison.

HERMAN PNEUMATIC MACHINE CO., Pittsburgh—A pain jar-ramming molding machine with a 13-inch cylinder and provided with a 40x50-inch table, will be shown; represented by H. T. Frauenheim, Robert Ringle, I. J. Oesterling, R. P. Morgan, Robert Porteous, W. W. Hughes, C. S. McMath and Thomas Kaveny.

HOEVEL MFG. CORP., New York.—This exhibit will be made in connection with that of George F. Pettinos, Philadelphia, and will consist of photographs of the sand-blast equipment built by this company; represented by L. B. Passmore.

HOLCOMB SAFETY GARMENT CO., Chicago—A complete line of safety garments for the protection of workers in steel, brass, iron and other metals, will be exhibited; represented by C. R. Holcomb and A. F. Cutter.

HOLLAND CORE OIL CO., Chicago—Samples of core oils, dry binders, parting compounds and core wash will be exhibited and sample cores also will be displayed, made in foundries using the core binders in their mixtures produced by this company; represented by H. L. Baumgardner, Garrett W. Doty, James M. O'Hara, Harry Whiting, R. E. Pickerell, Seth Vining, Sam Dykstra and A. G. Chambers.

HYATT ROLLER BEARING CO., New York—The diversity of applications of roller bearings to foundry equipment of all kinds will be demonstrated. This will include roller bearing-equipped I-beam trolleys, complete counter-shaft bearings, two small test cars, one equipped with roller bearings and one with plain bearings mounted on a T-rail to demonstrate the easy running qualities of roller bearing-equipped cars; roller bearings mounted in glass tubing and revolved by an electric motor to demonstrate the oil-distributing function of this bearing; a small model of a steel mill roller table equipped with roller bearings in self-aligning housings; an industrial truck wheel showing how easily these roller bearings are applied to a truck; samples of roller bearings used in all kinds of machinery and samples of line shaft roller bearings; represented by D. Gleisen, E. E. Eby, T. P. Cunningham, G. O. Helmstaedter, P. C. Gimlon.

ILLINOIS CLAY PRODUCTS CO., Oglesby, Ill.—Fire clay products.

IMPERIAL BRASS MFG. CO., Chicago.

INDUSTRIAL ELECTRIC FURNACE CO., Chicago—Enlarged photographs of electric furnace installations will be shown and the booth will be fitted up as an office and rest room; represented by C. B. Fletcher, F. Von Schegel, Geo. B. Cross and Russell T. Gray.

INTERNATIONAL MOLDING MACHINE CO., Chicago—When this was written this company was unable to state definitely whether any of its molding machines would be available for exhibition purposes. However, it is probable that several of these machines may be diverted temporarily for this purpose; represented by Edward A. Pridmore, W. W. Miller, F. W. Hamel, M. J. Monahan and E. G. Borgnis.

IRON TRADE REVIEW, THE, Cleveland—This booth will be fitted up as a rest room for visitors where all are invited to make their headquarters; represented by John A. Penton, A. O. Backert, J. D. Pease, H. Cole Estep, Charles J. Stark, R. V. Sawhill, V. G. Iden, George H. Manlove, S. H. Jasper, S. O. Hays, A. L. Klingeman, F. V. Cole, L. C. Pelott and D. M. Avey.

JENNISON-WRIGHT CO., Toledo, O.—Creosoted wood blocks for foundry and machine shop floors will be exhibited and, in addition, enlarged photographs of foundries and machine shops equipped with these floors will be shown; F. E. Jennison, F. M. Enwright, L. T. Ericson, R. R. Hone, J. A. Smith and H. M. Newton.

JURACK, CHARLES, PATTERN WORKS, Milwaukee—An assorted line of snap flasks will be displayed; represented by Charles G. Jurack.

KAWIN, CHARLES C., CO., Chicago—The booth of this company will be fitted up as a reception room where the representatives of this company may meet their clients and prospective clients; represented by Charles C. Kawin, J. F. Nellis, Charles A. LaFever, J. H. Hopp, James Jordan, William J. Mulcahy, A. M. Knight and R. F. Mains.

KEARNEY & TRECKER CO., Milwaukee—The machine tool exhibit to be made by this company will be operated and will include vertical and plain milling machines; represented by E. J. Kearney, Theodore Trecker, J. A. Camm, W. H. Allen and C. C. Bauschke.

KELLOGG, SPENCER & SONS, Inc., Buffalo—The extensive line of core oils manufactured by this company will be exhibited; represented by A. P. Mason, J. N. Yaeger and E. G. Allen.

KELLY REAMER CO., Cleveland—Boring and reaming tools and floating reamers will be displayed; represented by John M. Davie and James Gibbons.

KELLY, T. P. & CO., New York—The booth of this company will be fitted up as a reception and rest room; represented by V. J. Rohe, E. L. Schenck, H. J. Winters, J. F. Walter and Walter F. Kaine.

KEMPSMITH MFG. CO., Milwaukee—The motor-driven milling machine built by this company will be shown in operation; represented by Paul E. Thomas, John Goetz, Peter Lowe, F. M. Butterfield and Charles Drewes.

KING, JULIUS, OPTICAL CO., Chicago—A complete line of safety eye protectors, welders' helmets, babbitting masks and welding goggles will be displayd; represented by J. J. Duffy and A. G. Larson.

LACLEDE-CHRISTY CLAY PRODUCTS CO., St. Louis—Fire brick, fire clays and sleeves, nozzles and tuyeres for use by steel casting manufacturers will be exhibited; represented by J. H. McKelvey and E. C. Little.

LANE, H. M., CO., Detroit—Photographs illustrating foundries recently designed by this company, together with blue prints showing core racks, core ovens, skew cranes, etc., will be exhibited; represented by H. M. Lane, A. O. Thomas, Benjamin Towlen and H. VE. Mills.

LEEDS & NORTHRUP, Philadelphia.—Pyrometers.

LOCKE PATTERN WORKS, Detroit.—The complete metal pattern equipment for making a 155-millimeter howitzer shell will be exhibited, as well as mahogany patterns for government liberty trucks and an assortment of cast and aluminum plates for small parts of government tractors; represented by D. H. Locke.

LOEWENTHAL CO., Chicago—Yellow brass composition and remelted aluminum ingots will be displayed and castings produced from this metal also will be shown; represented by Edward B. Friedlander, Victor J. Lowewenthal, Jos. T. Yablitz, Samuel Livingston, Harry Seidenburg, A. O. Mason, Jr.

LUDLUM ELECTRIC FURNACE CORP., Chicago.—A model of the electric furnace built by this company will be shown, which will represent a furnace in actual operation. In addition, enlarged photographs will be displayed of this company's furnaces as installed; represented by H. E. Randall, Glen B. Hastings and John Kelley.

LUPTON'S, DAVID SONS CO., Philadelphia—Samples and models of the various types of steel sash manufactured by this company will be exhibited and a large number of photographs will be displayed showing examples of these installations and their use as well as foundries of the Pond truss design; represented by Clark Pond, C. P. F. Buckwalter and R. A. Sanborn.

McLEOD CO., Cincinnati.—Foundry equipment.

McCORMICK, J. S. CO., Pittsburgh—A general line of foundry supplies and facings will be shown, represented by J. S. McCormick, T. E. Malone, S. R. Costley, A. T. Richardson and S. M. Sheppard.

McCROSKY REAMER CO., Meadville, Pa.—The quick-change drill chuck with collets, made by this company, will be shown in operation. This chuck enables the operator to change tools without stopping his machine. This chuck will be in operation on a Reed-Prentice machine and, in addition, this display will include turrets, adjustable inserted blade reamers in hand, machine and shell types and the spiral fluted type for machine purposes; represented by C. M. Sutton and M. J. Foulk.

McLAIN-CARTER FURNACE CO., Milwaukee—Open-hearth steel castings poured from metal made in the McLain-Carter, oil-fired furnace will be displayed. Visitors interested in this steel process will be invited to inspect two of these furnaces in operation in Milwaukee; represented by David McLain, Frank Carter, Fred Smith and I. V. Scanlan.

McLAIN'S SYSTEM, Inc., Milwaukee—Samples of semi-steel castings of light section such as automobile cylinders containing from 20 to 50 per cent steel made by graduates from this school, will be displayed. Also, projectiles of 6-inch, 8-inch and other sizes containing 20 to 30 per cent steel scrap will be shown; represented by David McLain, I. V. Scanlan, Arthur Akey, Thomas McCarthy and Robert Moody.

MAGNETIC MFG. CO., Milwaukee—A magnetic separator for use in iron, steel and malleable iron foundries will be exhibited. This separator is provided with an elevator so that the metal may be dumped or shoveled directly onto a grating in the floor and is elevated into the separator. The sand then is screened out of the material for future use. The iron is extracted from the balance of the material and any coke, slag or other lumps are discharged into a separate receptacle. Other equipment that will be shown will include a magnetic pulley, 18-inches in diameter x 24 inches, and a magnetic pulley type separator 12 inches in diameter x 18 inches. These separators are used in foundries for removing iron and steel from waste metal and may also be employed in brass foundries for the separation of iron and steel from brass and aluminum turnings. Two brass separators also will be displayed used for separating brass and iron turnings; represented by Alvin Dings, Roswell Stears and John P. Bethke.

MAHR MFG. CO., Minneapolis—Fuel oil burning equipment will be exhibited including oil burning torches for cupola lighting, mold drying, preheating, etc., oil burning ladle heaters and driers, fuel oil core oven burners, fuel oil rivet forges, fuel oil melting furnaces and fuel oil annealing furnaces; represented by H. H. Warner, A. E. Stenzel, C. M. Simonds and W. F. Bohnhoff.

MAIL-O-METER SALES CO., Chicago—A tang for reclaiming any tang tool will be shown, as well as an automatic endorser and a machine for sealing, stamping and registering envelopes; represented by J. A. McFadyen.

MARDEN, ORTH & HASTINGS CORP., New York—A core sand binder will be exhibited together with samples of cores made by the use of this binder. The samples will demonstrate how this binder can be mixed to reduce the cost of binding materials generally; represented by George N. Moore and H. M. Handy.

MARSHALL & HUSCHART MACHINERY CO., Chicago.—Machine tools.

MAXON-PREMIX BURNER CO., Muncie, Ind.—Six different sizes of burners will be exhibited; represented by H. R. Maxon, M. W. Woodburn, R. P. Maynard, S. N. Maxon.

METAL & THERMIT CORP., New York—A large weld on a crank shaft made by the thermit process will be exhibited and a complete line of samples of all of the carbon-free metals and alloys made by this company will be displayed. Demonstrations of welding pipes with thermit will be continued throughout the week; represented by Arthur F. Braid, H. G. Spilsbury, J. G. McCarthy, W. R. Hulbert and C. D. Young.

MIFFLIN CHEMICAL CORP., Philadelphia.—The core binder manufactured by this company for foundry purposes will be exhibited; represented by P. Publicker and A. H. Selling.

MILBURN, ALEXANDER, CO., Baltimore—An oxy-acetylene torch which may be employed for both cutting and welding, combining the two operations in a single unit and which is guaranteed against back-fire on either operation, will be displayed. A high pressure acetylene generator will be exhibited and operated. This machine carries a 10 per cent overload which eliminates undue heating on standard

charges of carbide. Portable carbide lights also will form a part of this exhibit; represented by Charles R. Pollard, Stewart B. Moats, Alexander R. Boas, David Bartlett.

MODERN TOOL CO., Erie, Pa.—An 8x18-inch, self-contained plain grinding machine will be shown in operation and othehr features of the exhibit will include self-opening and adjustable screw-cutting die heads, adjustable collapsible taps, solid dies, adjustable hollow milling tools, chuck and collet equipment and tapping attachments; represented by R. H. Wood, E. V. McConville and C. E. McArthur.

MONARCH ENGINEERING & MFG. CO., Baltimore—An extensive display will be made of the line of metal-melting furnaces built by this company, as well as ovens and other foundry equipment. A new vertical tilting brass melting furnace without crucible, also will be exhibited; represented by James J. Allen, Harry D. Harvey, Frank Maujean and William Rabor.

MONROE CALCULATING MACHINE CO., Chicago—The calculating-adding machine built by this company will be exhibited. It not only adds, but subtracts, divides and multiplies; represented by Henry H. Doty, Walter H. Mann and Dorothy Drake.

MUMFORD MOLDING MACHINE CO., Chicago—A 10-inch high trunnion squeezer will be shown and large photographs will be displayed illustrating the sprue cutter handled by this company; represented by J. T. Lee, O. F. Weiss, E. P. Pitfield and J. O. Clark.

NAPIER SAW WORKS, Springfield, Mass.—Band saw machines, band and hack saws, band, hack and circular saws will be exhibited; represented by B. L. Calkins, L. C. Howard, J. J. Pendergast and J. H. Green.

NATIONAL ENGINEERING CO., Chicago—A foundry mixer 6 feet in diameter will be shown in operation. Photographs also will be displayed of a bucket loader, continuous core reducer, screen separator and other equipment essential to the mixing of sand in foundries; represented by H. S. Simpson.

NEW CHICAGO CRUCIBLE CO., Chicago—All kinds of graphite crucibles and graphite greases will be shown; represented by Dr. Sherman Taylor, A. F. Hottinger, H. J. Lucas, J. R. Crowe, J. P. Foraker and J. W. Mann.

NEW ERA MFG. CO., Kalamazoo, Mich.

NEW HAVEN SAND-BLAST CO., New Haven, Conn.—Photographs of installations of the extensive line of sand-blast machines built by this company will be exhibited; represented by C. A. Dreisbach, C. E. Billings and C. S. Johnson.

NICHOLLS, WM. H., CO., Inc., Brooklyn, N. Y.—A number of molding machines built by this company will be shown in operation, including combination jolt and power squeezer equipped with split pattern and stripping plates, plain jolt squeezer and plain jolt machine with a 6-inch piston and equipped with a 24x36-inch table; represented by William H. Nicholls and H. P. Mackinson.

NORMA CO. OF AMERICA, New York—Various types of ball and roller bearings manufactured by this company will be exhibited and their application to different kinds of machinery will be illustrated; represented by E. A. Perkins.

NORTON CO., Worcester, Mass.—A display will be made of grinding wheels especially adapted for foundry use, as well as those employed in the machine tool industry. In addition, refractory materials and rubbing bricks will be shown. A 2-inch floor grinder and a 1-inch bench grinder will be operated.

OAKLEY MACHINE TOOL CO., Cincinnati, O.—A universal cutter and tool grinder will be displayed; represented by R. L. Rickwood and A. A. Thayer.

OBERMAYER, S. CO., Chicago—Core ovens, sprue cutters, tumbling barrels, ladles and miscellaneous foundry equipment and supplies will be exhibited; represented by S. T. Johnston, J. E. Evans, C. M. Barker, Wm. Fenton, W. H. Fitzpatrick, Jr., W. M. Fitzpatrick, Sr., J. J. McDevitt, G. P. Peterson, O. J. Peterson and A. N. Wallin.

OLIVER MACHINERY CO., Grand Rapids, Mich.—An extensive display of patternmaking machinery will be made, all of which will be operated. This will include a universal wood milling machine especially designed for making patterns that cannot otherwise be constructed by machine; a 16-inch universal saw bench; 30-inch disc and spindle sander and a motor head speed lathe designed especially for alternate current; revolving oilstone grinder for sharpening edge tools; 6-inch hand planer and jointer; embossing press for making letters and figures; patternmaker's bench and an 18-inch x 8-foot tool room engine lathe equipped with the usual tool room attachments, such as taper, relieving attachment, draw-in attachments, etc.; represented by A. S. Kurkjian, J. C. Whitney, R. F. Baldwin and W. D. Baldwin.

OXWELD ACETYLENE CO., Chicago—This exhibit will include an oxweld generator and other apparatus for welding and cutting metals. This exhibit will be in charge of A. B. Rosenthal, George Ross, Carl Olson and E. D. Eddy. In addition the Prest-O-Lite Co., now represented by the Oxweld Acetylene Co., will have a working exhibit of Prest-O-Lite apparatus. This exhibit will be in charge of J. N. Walker and C. E. Sonday, L. E. Ogden.

PANGBORN CORP., Hagerstown, Md.—This operating exhibit will consist of new hygienic automatic sand-blast equipment complete with arrester system. This will comprise various types and sizes of machines to handle all classes of work including a continuous feed, self-contained, stationary nozzle cabinet sand-blast; continuous feed, self-contained cabinet sand-blast with supported movable nozzle adjustable in every direction; table cabinet sand-blast provided with hygienic direct high pressure equipment for large work and a shell cleaning cabinet sand-blast of the automatic continuous suction feed type. An additional display will be made of castings, before and after sand-blasting and large photographs will be shown of works installations of this sand-blast equipment for various classes and volumes of work; represented by Thomas W. Pangborn, John C. Pangborn H. D. Gates, W. C. Lytle, H. F. Liedtke, F. J. Hull, P. J. Potter, A. L. Holmes, George A. Cooley and Charles T. Bird.

PAWLING & HARNISCHFEGER CO., Milwaukee—This exhibit will include a ½-yard single line grab bucket and photographs will be displayed showing installations and detailed parts of cranes, hoists, grab buckets, drilling and boring machines and excavators; represented by Nicolaas Prakken, A. G. Henricks, Ben Van Horn, C. W. Goyette, A. W. Greetham and E. F. Zeisig.

PECK IRON AND STEEL WORKS, Kalamazoo, Mich.—Various sizes of pressed steel foundry flasks and a complete line of steel slip jackets and bands will be displayed; represented by William W. Peck.

PEERLESS MACHINE CO., Racine, Wis.—Metal-cutting machines will be displayed; represented by James A. Farrell.

PENTON PUBLISHING CO., Cleveland—This booth will be fitted up as a rest room for visitors where all are invited to make their headquarters; represented by John A. Penton, A. O. Backert, J. D. Pease, H. Colo Estep, Charles J. Stark, R. V. Sawhill, V. G. Iden, George H. Manlove, G. O. Hays, A. L. Klingeman, S. H. Jasper, F. V. Cole, L. C. Pelott and D. M. Avey.

PETTINOS, GEORGE F., Philadelphia—Samples of crude graphites and molding sands will be shown; represented by George F. Pettinos, H. B. Taylor, Jr. and L. B. Passmore.

PHOENIX MFG. CO., Eau Claire, Wis.—A turret attachment for engine lathes will be shown; represented by I. B. Roland, Martin A. Hanson and W. L. Harrison.

PICKANDS, BROWN & CO., Chicago.—An unusually attractive display of by-product coke will be made which will consist of an officers' tent at headquarters built of by-product coke. Foundry coke will be used for the front, back and sides, and the roof will be constructed of the various crushed sizes of coke. A flag pole will be installed from which the national emblem will be flown and the surroundings will be suitably decorated with ferns and plants; represented by J. A. Galligan.

PITTSBURGH FURNACE CO., Milwaukee—The electric furnace built by this company and installations thereof will be shown in a series of photographs; represented by R. C. Gosrow, W. E. Moore, E. Grubb and E. V. Kane.

PORTAGE SILICA CO., Youngstown, O.—The sand-blast and silica steel foundry sand mined by this company will be exhibited, as well as samples of the rock from which this material is obtained. Photographs of this company's extensive plant also will be exhibited; represented by E. E. Kooz and L. F. Farrell.

PRIDMORE, HENRY E., Chicago—The extensive line of molding machines to be displayed by this company will be shown in operation and will include a 24-inch, 9-inch drop combination electric jar-ramming and air power rock over hand draw machine; 24x24-inch, 8-inch draw combination electric jar-ramming and air power stripping plate machine; 16-inch, 9-inch drop combination electric jar-ramming and hand rock over drop machine; 29x24-inch, 8-inch drop power rock over drop machine; 22x18-inch, 8-inch drop rock over drop machine; 14x12-inch, 3-inch drop rock over drop core machine; 12x12-inch square stand machine and heavy double shaft stripping plate machine; represented by Mrs. Henry E. Pridmore, Henry A. Pridmore, Marshall Pridmore, D. F. Eagan, C. H. Ellis, J. W. Dopp, Hugh Gallagher, Henry G. Schlichter.

PROGRESSIVE METAL & REFINING CO., Milwaukee—An extensive display will be made of all kinds of brass and bronze ingots, virgin metal such as lake copper, spelter, aluminum, antimony, tin and other nonferrous metals, as well as 98 to 99 per cent pure ingot aluminum, No. 12 aluminum ingots, brick copper, white metals, etc.; represented by Sol Sadek, Max Sadek, Michael Sadek and Sam Sadek.

QUIGLEY FURNACE SPECIALTIES CO., New York—The use of high refractory furnace cement will be demonstrated by means of a small, high temperature electric furnace and a new insulating brick which this company in placing on the market will be shown; represented by W. S. Quigley, W. C. Bell, L. G. McPhee and R. A. Wirfs.

RACINE TOOL AND MACHINE CO., Racine, Wis.—A line of high speed metal-cutting machines will be displayed, including two of an entirely new type; represented by J. M. Jones, F. J. Kidd, D. B. Maxwell and P. H. Graves.

REPUBLIC CREOSOTING CO., Chicago.—The wood block business of the Ayer & Lord Tie Co. recently was taken over by this company and its exhibit will consist of a floor laid with creosoted wood blocks and enlarged photographs showing plants in which these floors have been installed; represented by C. P. Reilly, L. H. Blythe, L. S. Eifel and B. S. McConnell.

RICHARDS-WILCOX MFG. CO., Aurora, Ill.—Overhead carrying truck equipment for conveying loads in foundries and industrial plants as well as several sizes of trolleys and I-beam trucks with switches, curves, trolleys, hoists, etc., will be shown; represented by A. J. Eggleston and E. J. G. Phillips.

RIVETT LATHE & GRINDER CO., Boston—An extensive exhibit of machine tools will be made, including plain precision bench lathes, chasing bar lathe, back-geared precision lathe, mounted on an oak cabinet, internal grinders, a radial grinder, full automatic radial grinder and an improved thread tool; represented by A. F. Orcutt.

ROBESON PROCESS CO., New York—Cores made with glutrin as a binder will be exhibited and photographs also will be shown of the use of this material in coremaking operations generally; represented by C. A. Rapallo, T. J. Ryan and T. J. O'Hara.

ROGERS, BROWN & CO., Cincinnati—An unusual exhibit of various types of castings will be made, all of which enter into government work and are used in the construction of ordnance, the building of ships, etc. Samples of pig iron of different grades also will be shown; represented by S. W. Hubbard, Thomas A. Wilson, J. C. Mears, A. O. Sonne, A. D. Weaver F. W. Bauer and J. R. Horehead.

ROTHACKER FILM MFG. CO., Chicago.

SCHROETER ENGINEERING CO., Chicago—An elec-

trically-operated sand sifter will be exhibited. This is a new machine which riddles the sand by a gyratory movement, the sand inside of the riddle being thrown by centrifugal force toward the rim. The machine is arranged for lamp socket connection and the motor is fully enclosed. The machine may easily be raised or lowered to suit the convenience of the operator; repesented by J. Schroeter, W. Lindsay, S. Gimbel.

SHEPARD ELECTRIC CRANE & HOIST CO., Montour Falls, N. Y.—Owing to the fact that this company was unable to prepare any equipment for exhibition purposes, it has been decided to exhibit only large photographs of electric cranes and hoists for foundry use; represented by W. B. Briggs, R. H. McGredy and A. J. Barnes.

SHERIFFS MFG. CO., Milwaukee—Propeller wheels manufactured by this company will be displayed; represented by Thomas W. Sheriffs.

SIMONDS MFG. CO., Fitchburg, Mass.—The extensive line of metal-cutting saws, files and hack-saw blades manufactured by this company will be exhibited; represented by H. B. McDonald and J. W. McLean.

SLY, W. W., Co., Cleveland—A large horizontal sand-blast mill will be displayed and large photographs will be shown of installations of sand-blast equipment and other cleaning room machinery manufactured by this company; represented by W. C. Sly, G. J. Fanner, P. W. Graue, D. E. Hadley, R. F. Smith and E. J. Moore.

SMITH, R. P. & SONS, Chicago—Safety shows for molders and othehr employes of casting plants will be displayed; represented by J. B. Smith, Jr.

SMITH, WERNER G., CO., Cleveland—The complete line of core oils manufactured by this company will be displayed and the exhibit also will be made of foundry supplies, including fire brick, plumbago and parting; represented by Werner G. Smith, M. S. Finley, F. H. Dodge, Wm. E. Rayel, L. P. Robinson, A. L. Fay, R. H. Mills and Theodore Bornhoeft.

SOUTHWORTH MACHINE CO., Portland, Me. This exhibit will be made in connection with that of the Federal Machinery Sales Co., Chicago.

STANDARD OPTICAL CO., Geneva, N. Y.—A complete line of safety goggles for use in foundry and other industrial operations will be shown; represented by G. F. Dryburgh.

STANDARD SAND & MACHINE CO., Cleveland—A core and facing sand mixer, direct motor-driven, will be shown in operation; represented by Harry E. Boughton and P. E. Lacey.

STERLING WHEELBARROW CO., Milwaukee—A complete line of rolled steel foundry flasks and foundry wheelbarrows will be displayed. New types of reinforced flasks designed for extra heavy work and rough usage will be shown, as well as wheelbarrows equipped with springs for use in conveying cores; represented by I. R. Smith, H. H. Baker, J. J. Coyne, J. W. Dopp and E. W. Dowd.

STEVENS, FREDERIC B., Detroit—An extensive line of foundry and plating shop equipment and supplies will be exhibited; represented by James F. Hughes and Henry Krigner.

STODDER, W. F., Syracuse, N. Y.—A cyclone suction sand-blast nozzle will be displayed; represented by W. F. and M. A. Stodder.

STRONG, KENNARD & NUTT CO., Cleveland—This exhibit will consist of safety devices and first aid supplies, including goggles for chipping, welding and similar occupations, hospital furniture and supplies, molders' leggings and gloves, safety and danger signs, asbestos clothing, first aid cabinets, bulletin boards, respirators, sand-blast helmets and sanitary drinking fountains. A new non-shattering glass now used in goggles also will be demonstrated; represented by Buell W. Nutt.

SULLIVAN MACHINERY CO., Chicago—This exhibit will consist of an angle, compound belt-driven air compressor with a rated capacity of 445 cubic feet per minute against a pressure of 100 pounds per square inch. This compressor will be operated against 80 pounds pressure to supply air for the different exhibitors having foundry machinery in operation. It will be driven by a 75-horsepower General Electric motor. This compressor is of the latest design built by this company and has incorporated in its construction plate valves which are used in both the high and low pressure cylinders for both the inlet and discharge of the air. Another feature of this compressor is the atmospheric relief valve with which the high pressure cylinder is equipped and by means of which air remaining in the high pressure cylinder and intercooler is unloaded to the atmosphere during periods when the compressor is running without load, under the action of the total closure inlet unloader. This unloading device reduces the horsepower required for operation by eliminating useless work. A single stage, belt-driven air compressor also will be displayed and photographs will be exhibited illustrating other types of air compressors, air lift pumps and similar equipment for installation in casting plants; represented by Joseph H. Brown, Howard T. Walsh, S. B. King, H. L. Bernard and Alex F. Milne.

SWAN & FINCH CO., New York—Core oils and cores made with this company's liquid oil binder will be exhibited, together with high grade lubricating greases; represented by H. S. Chamberlin, William Sharp, J. A. Ellis, R. L. Babenroth, G. W. Hall, R. J. Kemp and Charles Howe.

TABOR MFG. CO., Philadelphia—An 18-inch portable combination shockless jar-ramming, roll over and pattern-drawing molding machine will be exhibited and other types of molding equipment made by this company will be illustrated by photographs; represented by Wilfred Lewis, H. W. Brown, J. T. Ramsden, J. P. Fender, J. Degler, W. E. Sewell, D. J. Martin, J. H. Coleman, H. W. Impey, G. L. Sumner, E. S. Lewis, Philip Shire and E. A. Platt.

SYRACUSE SANDER MFG. CO., Syracuse, N. Y.—Disc and spindle sanders for pattern shop use will be exhibited; represented by Edward Gordon.

THOMAS ELEVATOR CO., Chicago—Two or three-jaw chucks will be shown in operation on motor-driven machine tools and several other styles of chucks also will be exhibited; represented by J. J. Moore, W. A. Barker, J. A. Wheeler and Harry Cadman.

TORCHWELD EQUIPMENT CO., Chicago—Oxy-acetylene welding and cutting equipment and supplies will be shown, including welding, cutting, decarbonizing and lead-burning torches, regulators, hose, accessories, welding rods and fluxes, welding wire, etc. Some of the equipment will be operated and demonstrations will be made of cutting and welding metal; represented by C. J. Nyquist, W. A. Slack, Hal R. Fenstemaker and N. Davis.

UNITED COMPOUND CO., Buffalo—The vent and pattern wax manufactured by this company will be exhibited and samples of cores vented with this wax will be displayed; represented by J. W. and W. F. Bradley.

UNITED STATES GRAPHITE CO., Saginaw, Mich.—Samples of the large assortment of foundry facing manufactured by this company will be displayed; represented by J. G. Drought, E. S. Brownfield and C. H. Schenck, M. J. Houlihan and George D. Robinson.

U. S. MOLDING MACHINE CO., Cleveland—The extensive line of molding machines to be exhibited by this company will be operated and will include a plain air jolt machine, jolt and squeeze machine, jolt squeeze pattern-drawing machine, jolt pattern-drawing machine and a jolt roll over pattern-drawing machine and a plain air squeezer; represented by J. N., J. L. and C. F. Battenfeld and R. W. Gramling.

UNITED STATES SILICA CO., Chicago—Samples of sand-blast sand, steel molding sand, core sand, etc., will be exhibited and large photographs also will be on display showing the company's plant and manufacturing facilities. Samples of castings that have been sand-blasted with this abrasive also will be displayed; represented by A. Volney Foster, H. F. Goebig and Oliver Cook.

WADSWORTH CORE MACHINE & EQUIPMENT CO., Akron, O.—Coremaking machines and core room equipment will be displayed, including a motor-driven, self-contained coremaking machine, a core cutting-off coning machine, together with a complete line of steel reinforcing core and bottom plates. All of the machines exhibited will be operated; represented by G. H. Wadsworth and M. C. Sammons.

WALLACE, J. D., & CO., Chicago—A bench planer and a bench saw adapted for pattern shops and woodworking plants will be displayed. The bench saw is portable and may be operated on an electric lighting circuit. The saw tilts instead of the table so that any angle cut can be taken. The motor is direct-connected and has sufficient power to cut through the hardest kind of wood taking a 2-inch cut; represented by J. D. Wallace, C. H. Landis, G. C. Taylor and H. L. Ramsay.

WANGELIN, WALTER H., & CO., St. Louis—A calculator by which mixtures of iron may be rapidly figured will be exhibited; represented by Walter H. Wangelin.

WARNER & SWASEY Co., Cleveland—The machine tools to be exhibited will be operated and will include a universal motor-driven turret screw machine and operating on chuck work and a universal hollow hexagon motor-driven turret lathe operating on bar work; represented by A. C. Cook, H. E. Whitam, C. E. Neubert.

WHEELER, F. H., MFG. CO., Chicago—A complete line of protective wearing apparel will be shown, including asbestos, fireproof duck and leather leggings, gloves, mittens, spats, helmets, coats, pants, etc.; represented by F. H. Wheeler and E. L. Wheeler.

WESTERN ELECTRIC CO., New York.

WHITING FOUNDRY EQUIPMENT CO., Harvey, Ill.—Electrically-driven tumbling barrels, core ovens, worm-geared ladles, small air hoists, foundry trucks, turntables and other equipment for casting plants will be exhibited; represented by R. H. Bourne, P. A. Dratz, A. H. McDougall, H. P. Furlong and G. Schirmer.

WOODISON, E. J., CO., Detroit—An extensive line of molding machines will be shown in operation, including an electrically-driven jar-ramming roll over pattern-drawing machine; air squeezer, coremaking machine for automobile cylinders, universal sensitive core machine, etc. Other equipment will include a grinder and a feature of this company's exhibit will be a reproduction of its plant made from cores in which this company's oil binder has been used. In addition, an extensive line of foundry, platers' and polishers' supplies also will be shown; represented by E. J. Woodison, C. H. Woodison, J. C. Woodison, C. D. Yahne, W. J. Wark, U. W. Frink, M. A. Bell, W F. Haggman, R. S. Hoffman, G. A. Burman, J. F. Webb, William Maybank, William Muir, A. F. Jordan, W. W. Bowring, M. M. Werckman, F. F. Shortsleeves, J. M. Witters, H. S. Taylor and D. D. Baxter.

YOUNG BROS. CO., Detroit—The front half of a core oven, 8 x 12 feet, will be shown and at one side will be exhibited electric heaters, automatic temperature control and a control panel. On the other side wall will be mounted a gas burner with an automatic temperature controller as well as recording thermometer. The construction in section of this company's unit sheet steel insulated panels will be demonstrated and the arrangement for firing ovens by oil or coke furnaces below the floor level will be displayed. Photographs, photostats and blueprints of conveyor types of ovens will be displayed; represented by George A. Young, R. B. Reed, C. C. Bradford, G. G. Parry, H. L. Ritts and John F. Robinson.

Safety Council Offers Welfare Suggestions

Attention to Comfort and Safety of Workmen Produces Direct Improvements in Practice and Results in Modern Foundries

THE National Safety Council devoted an entire session to general and specific problems of the foundry industry at the seventh annual safety congress at the Hotel Statler, St. Louis, Sept. 16-20. The foundry meeting was one of four sessions devoted to the metals and metallurgy section of the industrial division. The subjects presented related to general well being as well as actual protection from injury. The attendance at the sessions was large and discussion was general, though no great diversity of opinion was developed.

Foundry management as related to accident prevention, lunch rooms, wash and locker rooms, presented subjects which were of importance to other branches of the iron and steel industry as well as to foundries. The subjects of eye protection, protective clothing and shoes were more closely allied with the foundry worker.

G. A. Hart, superintendent of the Melrose Park plant of the National Malleable Castings Co., set forth arguments to show that the foundry management is vitally interested in doing everything possible to prevent injuries to workers. Aside from the consideration of loss of valuable workers, permanently or temporarily, as a result of injuries, he believed that the greatest actual gain results from the interest the men take in bettering conditions. This often leads to improvements in practice, to the profit of the employer.

Mr. Hart summed up the experience of his company as follows:

After our safety organization had been in operation for some time we found our serious injuries began to reduce in number and our minor injuries to increase. This increase in minor injuries was caused by the men learning the importance of reporting such injuries as they previously had neglected. This reduced the number of infections. In fact, since our committees have been organized we have had no serious infections from injuries.

A never-ending campaign of education in accident prevention is necessary and all sorts of devices and methods are utilized to keep employes alert to prevent injuries to themselves and their fellow workers. Every effort is made to educate employes to a proper understanding and observation of the rules laid down for accident prevention. For violations distinction is made between errors in judgment and plain disregard of rules.

The workmen on the accident prevention committees have become much interested in this work and offer suggestions freely. They have learned to realize dangerous conditions and harmful practices. As a result such matters reach the notice of the plant safety committee promptly and the necessary action can be taken. The plant safety committee is practically an executive committee in passing on the recommendations of the department committees. In addition, however, each member of the first-named committee is ever watchful for the safety, comfort and welfare of the men. No safety suggestions are allowed to grow cold. If a safeguard is considered necessary it is installed immediately.

Occasionally some difficult problems may arise as to the best method of safeguarding a dangerous condition or overcoming a harmful practice. In such cases the matter usually is referred to the plant safety engineer for careful study and investigation. In a number of instances a decided improvement in methods of manufacture has been brought about by this procedure, which indicates clearly to us that the matter of safety has resulted in other benefits.

Value of the Lunch Room

The subject of lunch rooms was presented by H. H. Haylett, director of employment and welfare of the Benjamin Electric Co., Chicago. He spoke from his experience in charge of the lunch rooms and commissaries of the Commonwealth Steel Co., Granite City, Ill.

Mr. Haylett believes in the psychological benefits of plant lunchrooms in addition to the healthful value of food of good quality. Many workmen carry lunches from home which are not suitable. This may result from poor household arrangements or from economy. Others secure liquor and free lunch of the nearby saloon instead of real food. Wholesome luncheons at low cost in the company dining room supply the lack the other two plans present. The mutual association away from "shop etiquette" and restrictions have a healthful effect on the men mentally. Clean surroundings afford another aid to good digestion, which the lunchroom provides.

The works restaurant at the Commonwealth Steel Co. replaced a small leanto in which an outsider had been catering. The new scheme was founded to meet the following requirements: Convenience to the worker; attractive, light, airy, clean surroundings; prompt and adequate service; food of first-class quality, well prepared and served and in variety; prices only sufficient to cover cost; payment to cashier on leaving lunchroom by cash or coupon. Proper management is a large factor in the success or failure of such an undertaking.

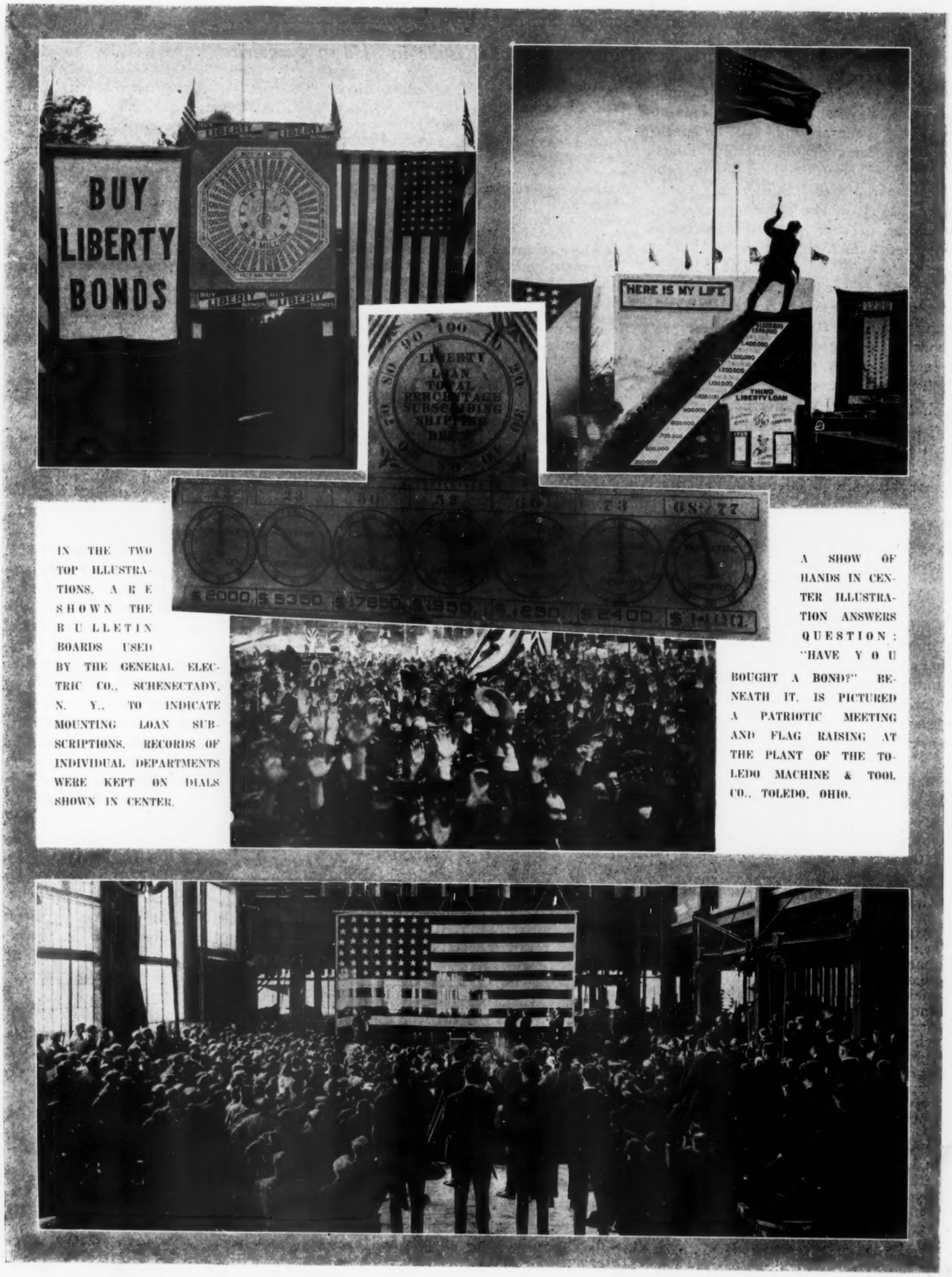
Much importance is attributed to properly equipped wash and locker rooms as a matter of making workers contented. In dealing with this feature of plant equipment H. L. Krum, works director of claims and safety of the International Harvester Co., Chicago, presented the opinion that men able to cleanse themselves from the soil of their work and change to their street clothes before leaving the plant have more self respect and therefore are better workers. The employer gains by this condition since the sight of a grimy worker is no incentive to young men to enter employment. The public has a better opinion of the plant whose workers come forth at the end of the day clean and neatly dressed.

Protection of workmen's eyes by goggles, both against injury by flying missiles and from undue heat or harmful light rays, has been a matter of much concern to foundrymen. Buell W. Nutt, of the Strong, Kennard & Nutt Co., Cleveland, presented the question of lenses and goggles. He referred to the fact that most lens glass came from Europe before the war and up to that time efforts in the United States to make what is used here had not been sufficiently successful to establish an industry. With European supply cut off an incentive was established and development has been rapid.

Before the start of the safety movement, he said, little attention was paid to the quality of glass used in goggles and tensile strength was not considered. First attempts at improvement involved the use of plate glass and then a flat optical glass. Then experiments were made to produce tough glass which would not crack when struck. The result has been a glass that will withstand heavy blows, and a late development has been a reinforced glass, consisting of two thicknesses with a

(Concluded on Page 494)

When Liberty Calls--The Foundry Trade Answers


BUY LIBERTY BONDS
HERE IS MY LIFE
THIRD LIBERTY LOAN
LIBERTY LOAN TOTAL PERCENTAGE SUBSCRIBING SHIPPING DE
$2000 $5350 $17850 $1950 $1250 $2400 $1400

IN THE TWO TOP ILLUSTRATIONS, ARE SHOWN THE BULLETIN BOARDS USED BY THE GENERAL ELECTRIC CO., SCHENECTADY, N. Y., TO INDICATE MOUNTING LOAN SUBSCRIPTIONS. RECORDS OF INDIVIDUAL DEPARTMENTS WERE KEPT ON DIALS SHOWN IN CENTER.

A SHOW OF HANDS IN CENTER ILLUSTRATION ANSWERS QUESTION: "HAVE YOU BOUGHT A BOND?" BENEATH IT, IS PICTURED A PATRIOTIC MEETING AND FLAG RAISING AT THE PLANT OF THE TOLEDO MACHINE & TOOL CO., TOLEDO, OHIO.

Foundrymen Plan For Fourth Liberty Loan

Industrial Forces Are Marshalled to Achieve Successes Over Here That Will Parallel Brilliant Efforts of Army in France

INTO the furnace of war raging over 3000 miles away, the United States has been sending her men during the past 17 months. In that period, a gold and silver mixture, valued in excess of $11,000,000,000, and obtained from three Liberty loans, has been placed in Uncle Sam's cupola. This has been poured out and the various molds which received it have produced food, clothes, equipment, ships, munitions, ordnance, etc., for the nation's army. This army now numbers approximately 4,000,000 men. We have in France either in battle or ready for it some 2,000,000 men, with more on this side of the ocean receiving a course of instruction preparatory to going over. All of this activity requires ever increasing expenditures. Another call has been sounded from Washington and between Sept. 28 and Oct. 19, the people of the United States, who form the stay-at-home army, are asked to subscribe to the fourth Liberty loan to total $6,000,000,000. Pouring iron in foundries has been designated as an essential occupation. Thousands of shells will soon be cast daily in this country's shops. An operation even more necessary for the successful prosecution of this greatest of all wars, is the loaning of funds to the government to receive in return first mortgages upon the country itself.

Germany has styled the United States a nation of money-mad patriots. The way this next loan, which is twice as large as any of its predecessors, will be oversubscribed will doubtless prove her in the right for once. Shortly after Oct. 19, Germany and her kaiser are due to realize that this nation is money-mad to the point of dedicating every dollar within its borders, not alone to equip properly our sons in the fight, but to finish the job the allied nations have on their hands and bring those sons back home.

Somebody has said that this war is a war of three Ms, men, materials and money. One of the biggest factors that presage success in this next loan campaign is the daily newspaper appearance of the casualty list. To bring to a speedy close the outlay of men, money must be forthcoming for materials, food, etc. Everybody wants the casualty list to cease its daily reminder of war's fearful cost and with one thought in mind, the people are getting ready to place their bond subscriptions. That thought is: "If so many men are willing to offer their lives in the cause of sane nations, why should there be any slacker dollars?"

Just what portion of the large oversubscriptions to the three previous loans came from the foundry industry is difficult to calculate. That its share was a large one is indicated by a perusal of the district figures on file in any federal reserve bank. This industry with all of its allied trades, is now preparing to exceed previous records. Every shop is busy lining up its organization.

Employes at the Schenectady, N. Y., works of the General Electric Co., who did such brilliant work on the three previous loans, promise a better record than ever. With the slogan "over the top for a million" a committee of 1000 members kept at it until the workpeople subscribed $1,057,400, $1,515,600 and $1,646,000, respectively, in the first three loans. The last loan was subscribed to by 96.7 per cent of the employes, who were informed of the progress of the drive by a large recording clock placed at the main entrance to the works. Each morning the pointer indicated the amount subscribed up to the previous night. In the yard, a large signboard was erected for the third loan, depicting a first line trench, with a soldier going over the top, and on each firing step, figures were printed from day to day, which indicated the progress toward the quota.

Patriotic rallies, meetings, parades, etc., were held at Schenectady and elsewhere; addresses were delivered by prominent men, in many cases on the company's time. All of this helped to arouse a brand of patriotism that comprises more than singing "The Star Spangled Banner" and saying "to hell with the kaiser." In connection with speeches to workmen, information comes from Washington that all returned soldiers who are able, will be asked to make addresses wherever desired. Applications for these talks should be filed with the local Liberty loan committee. Another successful campaign was carried on by the Norton Co., Worcester, Mass. This company encouraged departmental competition. Its plant was divided into 13 zones, each zone having a captain. A chart was posted showing daily progress made with the result that 3327 out of 3608 employes bought $271,200 worth of bonds in the second loan, three departments reaching the 100 per cent mark.

One concern to report itself 100 per cent on all three loans is the Herman Pneumatic Machine Co., Pittsburgh, which followed the usual policy of using the material sent out by the Liberty loan committee, giving prominent place to posters, etc., and arranging for the installment plan of bond payment.

Out of 52 employes in the Cleveland factory of the American Foundry Equipment Co., and the Sand Mixing Machine Co., Inc., 37 employes bought bonds to the total of $3000. Solicitation for these subscriptions was made in a personal way, and a large blueprint was made and posted as an honor roll giving the names of all purchasers.

The Barnett Foundry & Machine Co., Irvington, N. J., handled the first two loans itself and 85 per cent of its employes subscribed to the first loan, while 50 per cent signed for the second. An address by a four minute man coupled with personal solicitation brought subscriptions from 90

Statistics of First Three Loans

	First	Second	Third
Amount of loan	$2,000,000,000	$3,000,000,000	$3,000,000,000
Date of issue	June 15, 1917	Nov. 15, 1917	May 9, 1918
Date of maturity	June 15, 1947	Nov. 15, 1942	Sept. 15, 1928
Interest rate, per cent	3.50	4.00	4.25
Amount subscribed	$3,035,226,850	$4,617,532,300	$4,176,516,850
Amount over-subscribed	1,035,226,850	1,617,532,300	1,176,516,850
Per cent of over-subscription	52	54	39
Number of bond buyers	4,000,000	9,420,000	18,308,325
*Per cent of bond buyers	3.89	9.15	17.75
Average investment in bonds per purchaser	$765	$490	$228
*Average investment in bonds per capita	30	45	40

*Based on population of 103,000,000.

per cent in the third. For the fourth, the company intends to have some outsider make an address and is endeavoring to make arrangements with somebody who has seen service at the front. It feels that to bring the war home to the workmen in this way will bring an increased measure of success in this next drive. Early activities in the forthcoming campaign are expected to produce even better results.

It was only necessary for the International Molding Machine Co., Chicago, to circulate a list among its employes and fully 90 per cent responded, the others only being able to buy war savings stamps and thus help in a smaller way.

A large table was placed in the plant operated by the Adams Co., Dubuque, Ia., so that each employe had to pass it. As he passed, either Herbert Adams, secretary of the company, Frank B. Hird, or Robert Hird solicited his subscription. Thus 100 per cent of the employes subscribed to the third loan, making the effort a complete success. A similar campaign will be staged for the fourth loan since those in charge of it feel that each man must be made to realize that all must sacrifice—sacrifice until it hurts and then sacrifice some more.

Satisfactory Solder for Aluminum Bronze

A solder for aluminum bronze it is claimed can be made by melting together tin, 90 per cent; zinc, 5 per cent and mercury 5 per cent. However, it is doubtful if this solder can be made to adhere. A much better method of soldering this metal would be to first copper or nickelplate the object, and then solder in the usual manner with a mixture consisting of 50 per cent lead and 50 per cent tin. This makes a good, strong joint, that has been tested in actual service under severe conditions.

Alloy for Contact Points

A metallic alloy comprising nickel and tungsten with a considerable amount of carbon was patented recently by Henry K. Sandell, Chicago. It is said that this material is particularly adapted for the manufacture of contact points used in electrical work.

Briefly stated, the apparatus used in making the alloy consists of a carbon block having a trough in its upper surface which serves as a crucible for the production of the material. The crucible is heated by internally developed heat which is generated by an electric current. It is said that an alternating current gives the best results.

The metals to be combined should be of a pure state, it is pointed out, to yield the best results. After the metals are placed in the crucible, the latter is raised to a temperature sufficient to cause them to fuse. Powdered amorphous carbon, or powdered graphitic carbon is then added to the fused mass, during which time the molten alloy is stirred with a carbon stirring rod.

Shortly after the carbon has been added, the mixture solidifies or sets and the process is at an end. The current is now turned off, the crucible permitted to cool and the pig of alloy removed. To fabricate the material into contact points it can be filed, machined or ground.

It is said that this process produces a metal composition that is substantially homogeneous throughout its mass and which upon analysis shows a percentage of carbon by weight of from 2½ to 7 per cent.

What Bonds Will Buy

ONE $50 *Liberty bond will render 666 soldiers relatively safe from typhoid or will make* 400 *operations painless.*

One $100 *bond feeds a soldier for eight months.*

Three $100 *bonds clothe a soldier and feed him for one year in France.*

One $500 *bond buys supplies for the headquarters company of an infantry regiment.*

One $1000 *bond buys six cases of operating instruments for a base hospital.*

$1500 *worth of bonds will buy a motor ambulance.*

Two $1000 *bonds buy a motor truck.*

Three $1000 *bonds buy rifles for a field artillery battery.*

$5000 *worth of bonds will equip a company of an infantry regiment with rifles.*

$6000 *worth of bonds buys one Liberty motor.*

$9000 *worth of bonds will provide a rolling kitchen for field artillery brigade.*

$10,000 *worth of bonds fully equips three hospital wards of* 50 *beds each with beds made up and linen in reserve, chairs, tables, mirrors, foot tubs,* 120 *towels, bath robes, etc.*

$50,000 *worth of bonds will construct a base hospital with* 500 *beds.*

$100,000 *worth of bonds will buy five combat planes.*

Safety Council Offers Welfare Suggestions

(Concluded from Page 491)

film of celluloid cemented between. This latter type is approved by the United States bureau of standards and is being used by the government in gas masks and goggles. Coating a lens with a thin film of pure gold intercepts the infra-red rays and colored glass screens ultra violet.

Production of lenses that will not shatter and injure the eye when struck and broken has demolished the last refuge of the worker who is hostile to wearing goggles, though such men still are found, said the speaker. Some kind of force is necessary requiring them to be worn at all kinds of work where the danger to the eye is great.

B. C. Christy, safety inspector for the International Harvester Co., Chicago, argued for care in selection of shoes for workers about hot metal. The lace shoe wtih a heavy tongue in the experience of his company has been found superior to the gaiter, with rubber gores in the sides. The latter lose their life under heat and soon sag, leaving the top of the shoe in the shape of a receptacle into which hot metal easily finds a way in case of a spill or splash. In the discussion some reference was made to shoes with a metal cap over the toe instead of the usual leather or composition box. The general opinion was that this is no protection against a crushing injury as the metal will be driven down and clamped over the toes if the blow is sufficient to cause great injury. Better fitting of the lace shoe was argued since the gaiter tends to allow the foot to slip forward causing chafing.

Considerable stress was laid on the importance of proper hose and the use of care in lacing up the shoe to make it fit snugly and avoid irritating the skin through wrinkles in hose or tongue. Such irritation makes the worker less sure of his footing and is a possible cause of awkwardness, resulting in accident.

Cupola Tuyere Area

By W. J. Keep

Question:—What is the difference between the tuyere area of a cupola lined to 48 inches and one lined to 52 inches?

Answer:—It is a question of air inlet. The best shape of tuyere is one flaring at the sides so as to make the opening almost continuous at the surface of the lining. The following data have been taken from the catalog of a prominent manufacturer of cupolas. The blast indicated is 8 to 10 ounces,

but 14 to 16 ounces will give more satisfactory results. For a 48 and 54-inch cupola the tuyere area is 362 and 458 square inches, respectively; the volume or cubic feet of air per minute is 4700 and 5800, diameter of main blast pipe 18 inches and 20 inches, and melting capacity per hour 16,000 and 20,000 pounds, respectively.

A Simple Pattern Vibrator

The device shown in the accompanying illustration is a hand-operated pattern vibrator, recently patented by Hugh L. Walter, Guelph, Ont. The upper part of the central member *A* serves as a handle while the lower end is tapered to engage the gate hole in the pattern.

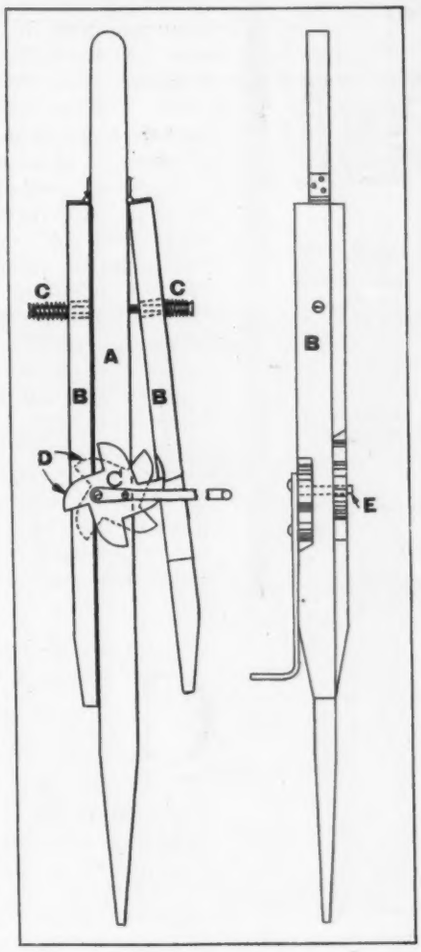
The vibratory motion is attained through the medium of two arms *B* which are hinged at the top. The inward movement of these arms is controlled by the two springs *C*. These arms are actuated by two ratchet wheels *D*. These are set staggered on the crankshaft *E* and in revolving they pass projections on the arms which set up the vibratory motion. This motion is transmitted to the pattern through the central member *A*.

Fluorspar Production Increases

Statistics of the fluorspar industry in 1917, prepared by the United States geological survey, show a great increase in the domestic output of this valuable fluxing mineral as compared with former years.

The shipments of spar from the mines in 1917 were 218,828 short tons, valued at $2,287,722, an average price of $10.45 a ton, compared with 155,735 tons, valued at $922,654, or $5.92 a ton, in 1916. This represents an increase in total tonnage of 40.5 per cent and in total value of nearly 148 per cent. The quantity of crude fluorspar mined in the United States in 1917 reached a total of 280,825 short tons, compared with 175,165 tons in 1916, an increase of more than 60 per cent. The stocks of marketable spar on hand at the end of 1917 amounted to 21,655 short tons, compared with 3666 tons at the end of 1916, but a considerable part of this stock was under contract, awaiting cars, boats, or weather favorable for shipment to plants.

The demand for fluorspar may be said to be governed mainly by the



A HAND-OPERATED DEVICE FOR VIBRATING PATTERNS

open-hearth steel industry, so that supplies that are within reach of steelmaking centers are certain to be drawn on heavily during war times. Mines in all producing states except Arizona reported an exceptionally heavy demand during 1917, and the high prices stimulated prospecting and led to the opening of many hitherto unworked deposits of fluorspar in Illinois, Kentucky, and Colorado.

Move Eastern Offices

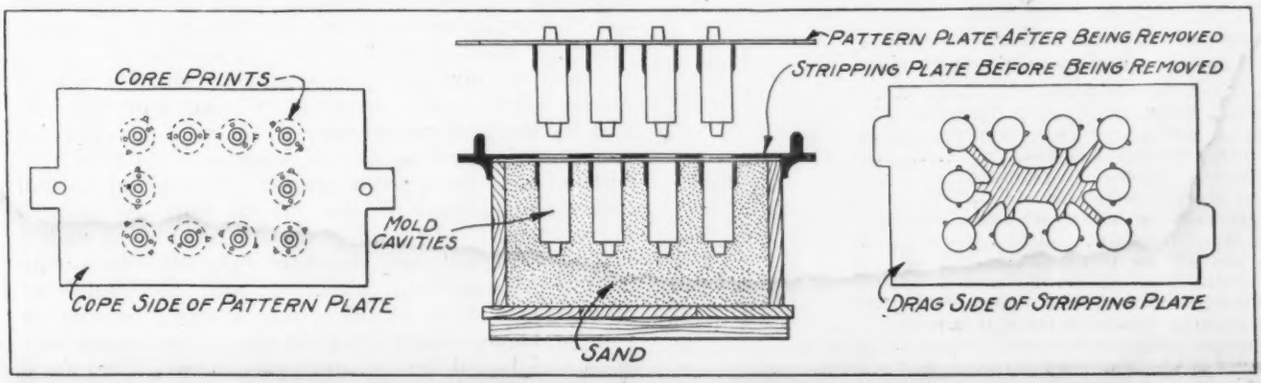
The eastern offices of THE FOUNDRY have been removed from 90 West street to rooms 2203-2206 St. Paul building, located at 220 Broadway, New York. The change was made in order to secure additional office space for the growing organization in the east.

Stripping Plate Device for Small Foundries

By H. D. Davis

An inexpensive stripping plate device which may be employed successfully by small foundries not equipped with molding machines, is shown in the accompanying illustration. It can be used for a large variety of work that has a straight joint or parting line. The patterns illustrated are axle boxes for wagon wheels. These are slightly tapered and are provided with offsets to prevent the boxes from turning. The stripping plates are made of ⅛-inch steel plate, one being provided for the patterns and the other for the stripping plate. In arranging the patterns for this work, the thickness of the stripping plate must be taken into consideration in every case.

When making the stripping plate the loose patterns are laid on the steel plate in the exact positions which they will occupy on the pattern and their locations are marked and openings are drilled through which the patterns are stripped. Slots are filed for the offsets on the patterns. The stripping plate then is laid on the pattern plate and the patterns are accurately located. Screw holes then are drilled in the pattern plate where the patterns are to be attached. The gate then is made and is attached to the stripping plate which then is ready for use. A plate of this kind may be used by a handy man and no difficulty will be experienced in drawing the pattern from completed mold.



PATTERN STRIPPING PLATE AND MOLD FOR MAKING AXLE BOXES

THE FOUNDRY

A monthly journal devoted to all branches of the foundry trade

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Pig Iron Advanced

DATING from Oct. 1 and continuing in effect to the first of the year, base prices of certain grades of pig iron have been advanced $1 a ton and changes also have been made from previous practices in the delivery of pig iron, changing the basing point to f. o. b. Birmingham, Ala., for all pig iron produced south of the Ohio river, but not including furnaces bordering on this river, and all pig iron produced in the eastern district in blast furnaces east of the Allegheny mountains and north of the Potomac river shall be sold on the f. o. b. Pittsburgh, basis. These changes in the basing points provide a further increase in prices of southern and eastern iron of from $2 to $3 per ton. As fixed by the war industries board and approved by the President, pig iron made in the Virginia, Tennessee and Birmingham districts, and the scattering districts south of the Ohio and Potomac rivers, including furnaces at St. Louis, but not including those bordering on the Ohio river, take the Birmingham basis. Pig iron from all other producing districts of furnaces shall be sold f. o. b. furnace, as heretofore. The new base price for No. 2 foundry iron will be $34 per gross ton, f. o. b. furnace; basic iron, $33; bessemer, $35.20; malleable iron, $34.50, and forge iron, $33. No. 2 foundry iron shall have a silicon content of 1.75 to 2.25 per cent and the sulphur must not exceed 0.05 per cent. Iron ore also was advanced 25 cents per ton at lower lake ports, including old range and Mesabi range bessemer and nonbessemer.

Foundrymen—Go to Milwaukee

CONSERVE manpower and win the war is the keynote of the great metals congress to be held in Milwaukee during the week of Oct. 7. It is the duty of manufacturers to release all available men for service at the front, but notwithstanding their reduced working forces they must maintain the production of essentials on the present or even an increased basis. It's a real job, but it can and will be done. Every man must do his bit and the foundrymen who must stay at home are going to do their part. How may this be accomplished? By the installation of labor-saving machinery and equipment wherever possible. The job must be done and to enable foundrymen to make their selection from a wide assortment of tools the exhibition at Milwaukee is being held. Appreciating the serious situation confronting the metal-working industries generally, a greater number of equipment builders are making exhibits this year than heretofore. Many displays are being made at a great sacrifice, both in men and machines, temporarily diverted from other duties and uses. For this reason alone, there should be a record-breaking attendance. But there is another reason of far greater importance. Every foundryman will have to buy labor-saving equipment of some kind and this will be his best opportunity to do so. Arrayed for his inspection will be a large number of tools of different types for a given specific purpose and he will have an opportunity to select the machine best adapted to his needs. The program of the four technical societies that will meet simultaneously are filled to the limit with papers and addresses, both interesting and instructive. Many of these have a direct bearing on your problems arising from the war. You should hear them. All will be of practical value. Therefore, FOUNDRYMEN—GO TO MILWAUKEE.

COMINGS AND GOINGS OF FOUNDRYMEN

Benj. D. Fuller, who has been affiliated for many years with the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has tendered his resignation as superintendent of the foundries operated by this company. During the past eight years Mr. Fuller has been located in Cleveland, in direct charge of the large gray and malleable iron foundries operated by the Westinghouse Co. in that city. Prior to that time Mr. Fuller was located in Pittsburgh. On Oct. 15, Mr. Fuller accepts a position as vice president and manager of interests controlled by W. D. Uptegraff, Pittsburgh, including the Niagara Electric Furnace Co., Defiance Paper Co. and the Niagara Wall Paper Co., all located at Niagara Falls, N. Y. Mr. Fuller is president of the American Foundrymen's association, and also is a member of the committee on iron and steel scrap of the American Iron and Steel institute. He is a past president of the Pittsburgh Foundrymen's association and has been a director of the American Foundrymen's association for many years. The employes of the Cleveland plant of the Westinghouse Electric & Mfg. Co., presented Mr. Fuller with a gold watch, chain and penknife and a handsomely embossed testimonial in appreciation of the many kindnesses of their former superintendent.

J. J. Trefez has resigned as superintendent of the Anglo-American Mill Co., Owensboro, Ky., to become general manager of the Southern Foundry Co. of that city.

W. L. Chatfield has resigned as superintendent of the Manufacturers Foundry Co., Milwaukee, and has accepted a position as foundry superintendent and chemist of the Kanawha Mfg. Co., Charleston, W. Va.

L. M. Eyke, Terre Haute Malleable Iron Co., Terre Haute, Ind., has been elected vice president of the Terre Haute Manufacturers' association.

Arthur Aigeltinger has been elected president of the American Malleable Co., Lancaster, N. Y., succeeding A. S. Blagden who resigned to become vice president and general manager of the Air Reduction Co.

William H. Armstrong has resigned as secretary and treasurer of the Mitchell Motors Co., Racine, Wis., to become president of the newly organized Armstrong Foundry Co., Racine. This company was formerly the Holbrook-Armstrong Iron Co.

Frank P. Obenberger has resigned as general superintendent of the A. O. Smith Corp., Milwaukee, to become associated with his father in the management of the John Obenberger Forge Co., West Allis, Milwaukee.

James Jordan, foundry expert for the Charles C. Kawin Co., Chicago,

BENJ. D. FULLER

has been given entire charge of the foundry advisory department of that company at Toronto and Buffalo. Mr. Jordan was formerly with the Altman-Taylor Co., Mansfield, O.

Zeno D. Barnes, who has been connected with the Westinghouse Air Brake Co. in the capacity of nonferrous metallurgist, now is affiliated with the general operating department of the Aluminum Castings Co., Cleveland.

A. J. Barnes has been appointed export manager of the Shepard Electric Crane & Hoist Co., Montour Falls, N. Y., with headquarters at the main office. Mr. Barnes also will continue to be director of publicity.

Maj. W. A. Garrett of the Remington Arms Co. addressed a meeting of the Philadelphia Foundrymen's association at the Manufacturers' club in Philadelphia, Sept. 4. Major Garrett related his experience on the western front during the early drive last spring.

B. H. Tripp, special Pacific coast representative of the Chicago Pneumatic Tool Co., Chicago, has succeeded M. W. Priseler as district manager of sales for the Pacific coast territory. His headquarters are at 627 Howard street, San Francisco. He also will have charge of the Los Angeles branch of this company.

Payne G. West has been appointed assistant manager of field sales for the Lakewood Engineering Co., Cleveland. Mr. West is a graduate of Carroll college, and studied civil engineering at the University of Wisconsin. For nearly 12 years Mr. West was affiliated with the T. L. Smith Co., Milwaukee, and for the greater part of this period he was assistant sales manager.

S. Griswold Flagg 3d, junior partner of Stanley G. Flagg & Co., Philadelphia, and manager of its Pottstown, Pa., plant, has been commissioned a naval constructor with rank of lieutenant, senior grade, and has been called to active service at the naval aircraft factory, League Island navy yard, Philadelphia. He has been appointed assistant general manager of this plant and has been placed in charge of aircraft factory No. 1.

W. H. Hill, first vice president, American Radiator Co., Chicago, has assumed the duties of vice president in charge of operations and director of munitions. He has removed from Chicago to Buffalo where he will be in direct charge of the works for the duration of the war. He will succeed A. A. Landon, vice president of the American Radiator Co., who recently was appointed chairman of the Aircraft board.

T. Finnegan, formerly Pacific coast manager of the American Brake Shoe & Foundry Co., New York, has been appointed vice president in charge of the western district with headquarters at 332 South Michigan avenue, Chicago. Mr. Finnegan will have charge of the operating and sales department. A. G. Delaney, formerly affiliated with the Chicago office of the American Brake Shoe & Foundry Co., has been appointed manager of plants and sales with headquarters at Minneapolis, succeeding E. M. Vilas.

Equipment for Iron, Steel and Brass Foundries

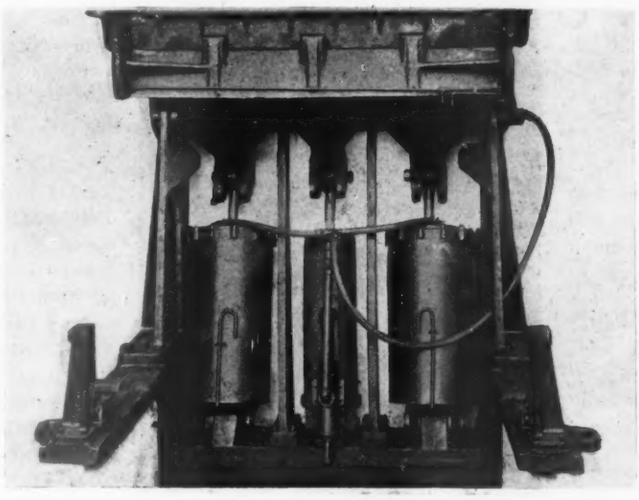
Electric Jar-Ramming, Rock-Over and Pattern-Drawing Unit for Large Molds—An Automatic Positive Pressure Sand-Blast Machine

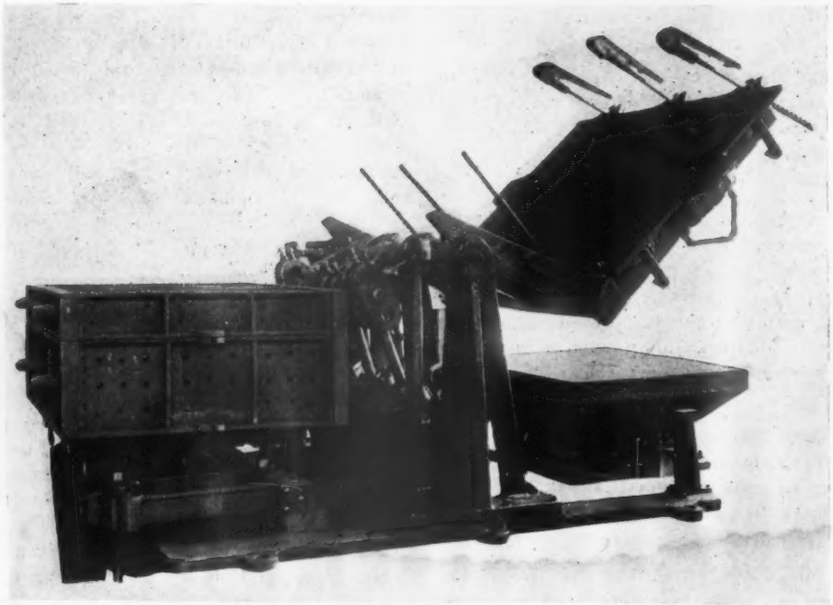
THE rapidly growing requirements of the war, coupled with the continual transfer of men from industries to the army, has created a demand for molding machines of larger size and greater capacity than any ever built before. To meet this demand, Henry E. Pridmore, Chicago, has designed a 60-inch table, 24-inch drop power rock-over, power-draw machine which will handle flasks weighing 8000 pounds. This machine is operated in connection with an electric jarring machine, forming a complete jar-ramming, rock-over and pattern-drawing unit.

The initial machine of this size was built for the General Motors Truck Co. for the purpose of increasing the production of large steel tractor wheels. Prior to the construction of the machine, the General Motors company was able to obtain only three molds a day from three men. With the aid of the machine this production has been increased over 500 per cent, with the same number of men employed. The tractor wheels are designed with staggard grip-service treads. The grips run at an angle from the center to the outside of the rim of the wheel. It is necessary, therefore, to form the outside of the wheel in a sectional core which is made in five parts and assembled before it is set in the mold. These cores make it necessary to use an exceptionally large flask.

The principal features of the machine are shown in the accompanying illustration. The rock-over mechanism has a 60-inch table and a 24-inch drop. For the jar-ramming operation, a standard 50 x 60-inch Pridmore electric jarring machine is employed. In the General Motors Truck Co.'s foundry, this machine is employed exclusively in making drag molds for tractor wheels. The copes are made on a plain 48 x 48-inch electric jarring machine. A 24-inch table, 9-inch drop, jolt, power rock-over drop machine of standard construction is utilized for molding the cores.

The new large 60-inch power rock-over machine has two 18-inch roll-over cylinders and one 12-inch oil check cylinder. The latter counterbalances the weight of the flask when it is rolled over. The arrangement of the three cylinders is shown clearly in Fig. 1. Fig. 3 illustrates the details of the oil check cylinder. The piston in this cylinder is provided with three large ball checks and three small holes. The flow of the oil is controlled by an automatic valve which goes into action as the load passes over the center. When this valve is closed, the oil is prevented from flowing from one end of the cylinder to the other through the bypass pipe shown in Fig. 3. The oil, therefore, forms a cushion and is fed slowly through the three small holes in the piston. The automatic valve and ball checks are





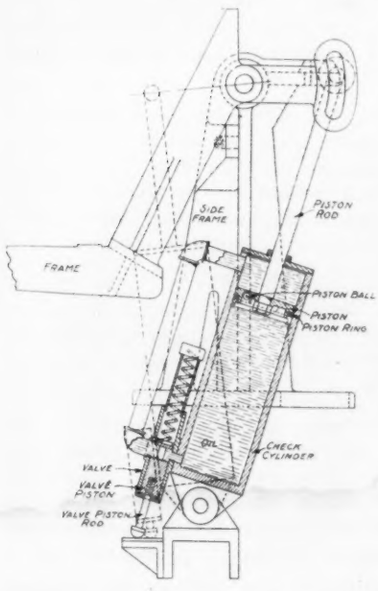


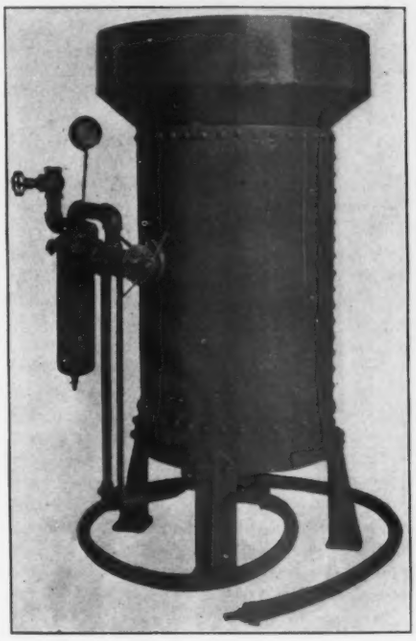
FIG. 1—THE OIL CHECK CYLINDER IS IN THE MIDDLE WITH THE TWO ROLL-OVER CYLINDERS ON EITHER SIDE. FIG. 2—GENERAL VIEW OF LARGE PRIDMORE COMBINATION ROLL-OVER JAR-RAMMING MACHINE. FIG. 3—SECTIONAL VIEW OF OIL CUSHIONING MECHANISM

so arranged that this cylinder does not impede the speed of the machine on the reroll operation.

The pattern draw is of the Pridmore oil cushion type, with the draw on the center of the cylinder. The centers of the flask rests or leveling device can be adjusted from 40 to 68 inches apart in order to take care of different lengths of flasks. The power applied to all parts of the mechanism is controlled by one valve. This materially simplifies the operation of the machine.

Automatic, Positive Pressure Sand-Blast Machine

An automatically-operated, positive pressure sand-blast machine, as shown in the accompanying illustration, has been developed by the W. W. Sly Mfg. Co., Cleveland. The mixing chamber, located under the lower head of the machine, is cast in one piece and is provided with a plate upon which the sand is fed from the tank by passing through an inverted, tapered feed sleeve. The latter prevents the passage into the mixing chamber of any particles that cannot be discharged from the nozzle. After the sand has been discharged upon the sand plate by the feed sleeve, it is carried forward by air from an adjustable port which provides for the control of the flow of sand. The air passing this port is divided by a deflector cast integral with the mixing chamber casting so that the walls which otherwise would be subjected to the action of the sand, are protected by air and the sand is carried off by that portion of the blast deflected toward the center. The velocity of the air passing over the plate is sufficient only to carry the desired amount of sand forward to a point just below the entrance to the hose where it comes in contact and is carried by the air projected at high velocity. It is pointed out that in this way wear in the mixing chamber is almost entirely eliminated.



POSITIVE PRESSURE SAND BLAST MACHINE BUILT BY THE W. W. SLY MFG. CO., CLEVELAND

The operation of the tank is controlled by a manifold valve located on the side of the machine in a convenient position for the operator. The valve has only one lever and one progressive movement, forward and reverse, but this is sufficient to fill the tank, to admit the air and to adjust the sand feed. The feed valve on top of the tank remains open when the tank is not in use and the sand, or other abrasive, is fed from a storage hopper located above the tank and falls by gravity through a screen into the machine until the tank is filled. Turning the lever on the manifold to the first position, admits air to the tank through a pipe directly underneath, upon which the filling valve rests. The impact of the air upon the bottom of the valve causes it to rise and close the filling opening, but air is permitted to enter the tank through exposed portions while still holding the valve on its seat. The air pressure then builds up in the tank holding the valve firmly upon its seat and the next forward movement of the manifold lever permits the air to flow into the velocity chamber mixer. A continued forward movement opens the air port and carries the sand forward into the mixing chamber, the amount of sand desired being regulated by the progressive, forward movement lever. The volume of blasting air remains constant while the valve lever is being moved. If the sand flow becomes impeded, the forward movement of the valve lever beyond the supply of maximum sand to the hose and nozzle releases the sand in the tank and reverses the flow through the bottom. This is relied upon to break down any bank of sand or to remove an obstruction from the top of the feed sleeve, thus permitting the operator to continue work until the sand in the tank has become exhausted.

WHAT THE FOUNDRIES ARE DOING

Activities of the Iron, Steel and Brass Shops

Alex. Kilpatrick & Sons, St. Louis, recently awarded contracts for increasing the capacity of its foundry.

The Salmon Bay Foundry Co., Seattle, Wash., will build a 40 x 140-foot foundry.

The Light Mfg. & Foundry Co., West Chester, Pa., plans to build a 32 x 180-foot addition to its plant.

The Stern Foundry & Machine Co., New Orleans, will build an addition to its plant.

The Charles Bohn Foundry Co., Detroit, recently let contracts for the erection of a foundry.

The Wilcox Foundry Co., Wheeling, W. Va., recently was organized. Albert C. Wilcox is president.

The Canton Steel Foundry, Canton, O., is building a machine shop and other additions.

The Long & Alstatter Co., Hamilton, O., has commenced work on the construction of a foundry adjoining its plant.

The Colvin Foundry Co., Providence, R. I., recently let a contract for the erection of a reinforced concrete, 2-story, 28 x 38-foot addition to its plant.

The American Steel Foundries, Chicago, is contemplating the erection of an annealing building as an addition to its Chester, Pa., plant.

Work is to start shortly on the erection of an addition to the foundry of the Lumen Bearing Co., Buffalo. Plans have not been completed.

The Western Foundry & Machine Co., Granite City, Ill., has bought the foundry of the Wahle Foundry & Machine Co., Davenport, Ia.

The Alton Foundry & Machine Co., Lancaster, O., contemplates the erection of an addition to its foundry.

The Vulcan Foundry Co., 15 Exchange place, Jersey City, N. J., recently was incorporated with $100,000 capital to engage in the foundry business.

The North End Foundry Co., West Allis, Wis., will erect a brick and steel addition to its gray iron shop which will be 60 x 80 feet and cost about $20,000 with complete new equipment.

The Catchpole Boiler Works, Geneva, N. Y., has had plans prepared for the erection of an addition to its foundry, 30 x 87 feet.

The Germann Bronze Co., Erie, Pa., recently had plans prepared for the erection of an addition to its foundry.

The Superior Bronze Co., Erie, Pa., recently had plans prepared for the erection of an extension to its foundry.

The Detroit Foundry Co., Detroit, is contemplating the erection of additions to its foundry, to be built at a cost of $10,000.

The Freeland Foundry & Machinery Co., Hazleton, Pa., will specialize in the manufacture of ship propellers for the United States shipping board.

The Buick Motors Co., Flint, Mich., contemplates the erection of an aluminum foundry, one and two

stories, 120 x 300 feet and 90 x 240 feet, to cost $200,000.

The Northwest Motor Co., Seattle, Wash., recently awarded a contract for the erection of a foundry, 100 x 200 feet.

The American Marine Iron Works, St. John, Oreg., which was recently incorporated, is equipping a foundry and machine shop on the Williamette river.

The Prier Brass Mfg. Co., Marshalltown, Ia., is expected to start work soon on the erection of a 60 x 160-foot foundry.

The Milwaukee Steel Foundry Co., Milwaukee, is building a large addition to its plant and is equipping it with a 3-ton Heroult furnace.

The Montague Iron Works, Montague, Mich., is contemplating the erection of a large machine shop and foundry addition to its plant.

The McCann Mfg. Co., Springfield, Ill., has had plans prepared for the erection of an addition to its plant, which includes a foundry.

The Schom Jackson Co., Philadelphia, is contemplating the erection of a 18 x 20-foot addition to its foundry.

The Bausch & Lomb Optical Co., Rochester, N. Y., recently awarded a contract for the erection of a 81 x 92 x 116-foot foundry, to cost $250,000.

The National Brake & Electric Co., Milwaukee, is reported to be investing approximately $200,000 in etxensions and improvements to its iron foundry.

Fire badly damaged the plant of the Hessler Foundry & Mfg. Co., Oswego, N. Y. The plant will be rebuilt.

The Vulcan Foundry Co., Jersey City, N. J., has been incorporated with a capital of $100,000, by H. A. Black, A. F. McCabe and J. W. Stout.

The Baker Iron Works, Los Angeles, Cal., has had plans prepared for the construction of a 70 x 80-foot addition to its foundry.

The Standard Foundry Co., Cleveland, has awarded a contract for the erection of a foundry on Grand avenue, to be 60 x 84 feet.

The Swedish Crucible Steel Co., Detroit, recently awarded the contract for the construction of two 45 x 240 and 90 x 240-foot foundries.

The A. & F. Brown Co., Elizabethport, N. J., manufacturer of machinery, is making improvements to its foundry, at a cost of $15,000.

The Canadian Allis-Chalmers Co., Lansdowne avenue, Toronto, will build an addition to its gray iron foundry to cost $20,000.

The Gilbert Hunt Foundry, Walla Walla, Wash., has been reopened by A. L. Galdwin and Charles Hoffman.

The foundry of Wildman & Mahony, Sutter Creek, Cal., is being dismantled and the machinery and material are being sold.

The Hoskins Mfg. Co., Detroit, manufacturer of electrical measuring instruments, is building a foundry, 60 x 110 feet, at its Lawton street plant.

The Albert Pudrith Co., East Fort street, Detroit, is planning the immediate erection of a foundry on Hart avenue.

The Athens Foundry & Machine Co., Athens, Ga., is planning the construction of an addition, 40 x 240 feet. O. H. Arnold is president of the company.

The Kearny Brass Foundry, Kearny, N. J., has been incorporated with a capital of $25,000, by Jacob C. Chadwick, Samuel P. Blauvelt and others.

The Philbrick-Booth Foundry Co., Hartford, Conn., has awarded a contract for the erection of an addition, 40 x 50 feet.

The Ornamental Foundry Co., Anniston, Ala., is planning to rebuild its foundry, badly damaged by fire late in August. The company has been specializing in the manufacture of cast iron posts.

William P. Whitney, architect, 943 First National Bank building, Chicago, has prepared plans for a foundry, 124 x 160 feet, to be erected at Clearing, Ill. The name of the owner has not been announced.

The Wellman-Seaver-Morgan Co., Cleveland, will soon award the contract for the erection of an addition to its plant at Akron, O., which it is estimated will cost $80,000.

The Central Foundry Co., 90 West street, New York, with works at Newark, N. J., is said to be planning the establishment of plants at Holt and Bessemer, Ala., for the manufacture of munitions.

The Columbia Block & Tool Co., Vancouver, B. C., will build a foundry, 50 x 150 feet, and a machine shop, 50 x 150 feet, at a cost of $30,000. A traveling crane will be part of the new equipment to be installed.

The Girard Iron Works, Philadelphia, has sold its foundry, shops, office and other buildings at Twenty-second street and Allegheny avenue, to the Aetna Foundry Co., for about $47,000.

The John Polachek Bronze & Iron Co., 480 Hancock street, Long Island City, N. Y., recently awarded a contract for the erection of a foundry to cost about $35,000.

The St. Maurice Foundry Co., Ltd., Three Rivers, Que., is contemplating the erection of an addition to its plant to cost about $15,000. C. H. French is manager.

The Bayley Mfg. Co., 732 Greenbush street, Milwaukee, has deferred the construction of a gray iron foundry, as it has been able to make satisfactory connections for its supply of castings from existing shops.

The American Steel & Machinery Co., Mansfield, O., which has about completed a new plant, will erect several additions, consisting of a forge shop, 127 x 400 feet, a steel foundry, 180 x 300 feet and an annealing department, 130 x 336 feet.

The Chesapeake & Ohio railroad, Richmond, Va., will soon start on the erection of a foundry, 50 x 245 feet, to cost about $5000. The Arnold Co., Chicago, is the engineer in charge of the construction.

The new foundry to be erected by the National Steel Products Co., Birmingham, Ala., will consist of a 1-story building, 40 x 150 feet, and will be equipped for the production of steel castings. W. J. Long is president.

The Alloy Foundry & Machine Corp., New Rochelle, N. Y., has been incorporated with a capital of $9000 to manufacture castings, etc., by H. Oppenheim, H. Werner and P. S. Feldman, 450 Fourth avenue.

The Kennedy Valve Co., Elmira, N. Y., recently completed a large addition to its iron foundry, which is to be utilized as a storage department, to release space in another part of the shop for the installation of additional molding machines.

After being idle since early in July, the Colonial Foundry & Machine Works, Columbia, Pa., operated by J. E. Baker & Co., resumed operations recently. Eugene Andes has succeeded James A. Constantine as superintendent.

Johnson's Brass Foundry Co., Pawtucket, R. I., has been incorporated with $10,000 capital to operate a foundry and machine shop. The incorporators are Herbert Johnson, 388 Orms street, Providence, R. I.; Fred Sheriff and James E. Brennan, Providence.

The Toledo Furnace Co., Toledo, O., will soon award the contract for the erection of a 1 and 2-story, 32 x 72, 32 x 80 and 54 x 151-foot plant, which will include a laboratory, foundry and two factories. It is estimated the plant will cost about $100,000. F. Warner, 768 Hippodrome building, Cleveland, is in charge of the work.

NEW TRADE PUBLICATIONS

PNEUMATIC TOOLS.—The Independent Pneumatic Tool Co., Chicago, has issued a 4-page bulletin which briefly describes a large number of its types of pneumatic and electric tools for drilling, reaming, grinding, etc. Several types of pneumatic riveting and chipping hammers with inside and outside triggers also are described and illustrated.

SAND BLAST PRINCIPLES AND DATA.—An 8-page bulletin, issued by the Pangborn Corp., Hagerstown, Md., devoted to sand-blasting, is unique since it treats almost entirely of this subject, from an educational standpoint, minimizing reference to the company's products. The principles of sand-blasting are discussed at length and numerous valuable tables are included. The air compressor, its operation, etc., also receives attention, and abrasives, general ventilation, and dust arresters also are given consideration. The bulletin should prove of value to all users of sand-blast equipment.

SAFETY GOGGLES. A well-illustrated 24-page catalog, entitled "Save Your Workmen's Eyes," has been issued by the Julius King Optical Co., New York. A large assortment of goggles adapted to practically all industrial operations where the eyes are in danger, is shown. In the construction of these goggles, the lenses receive special attention and all goggles manufactured are provided with surface-ground lenses which are clear, bright and of great transparency. Furthermore, it is claimed that these lenses will not splinter when broken. Among the goggles shown are those equipped with different types of side frames, particularly recommended for workers engaged in chipping or chiseling in metal and breaking or drilling brick or stone. Various types of welders' goggles are illustrated as well as respirators, welders' helmets, face masks, battitting masks, etc.

AIR SEPARATOR.—An 8-page bulletin issued by the Griscom-Russell Co., 90 West street, New York, is devoted to the air separator which it manufactures for the purpose of removing water from compressed air before the air is used. This separator is recommended for installation, as near as possible to the point at which the air is to be used, since it is more advantageous to install a number of small separators on branch lines to the machines or tools, than to install one large separator on the main air line from the compressor. Foundrymen operating sand-blast machines appreciate the annoyances caused by wet sand from the compressed air line and the advantages of an air separator, therefore, are apparent. The bulletin includes a table of dimensions and a partial list of owners of this device.

BUCKET LOADER.—A 4-page bulletin issued by the National Engineering Co., Chicago, is devoted to its new bucket loader for feeding sand into the mixer manufactured by this company. This loader was designed to meet a demand for a charging apparatus that would contain the correct amount of any particular sand mixture to be fed into the machine and at the same time to secure the maximum capacity from the mixer and to eliminate hand labor as much as possible. The power required to lift the bucket loader is taken from the driving shaft of the mixer and by means of a clutch mechanism the bucket is elevated to a point where the material falls into the machine and is lowered again against a brake for the next charge.